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MAY 1986
VOLUME 4
NUMBER 5

HANDS ON REVIEW
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MAY
1986

VOLUME 4
NUMBER 5

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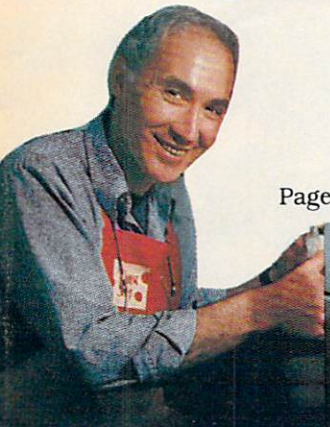

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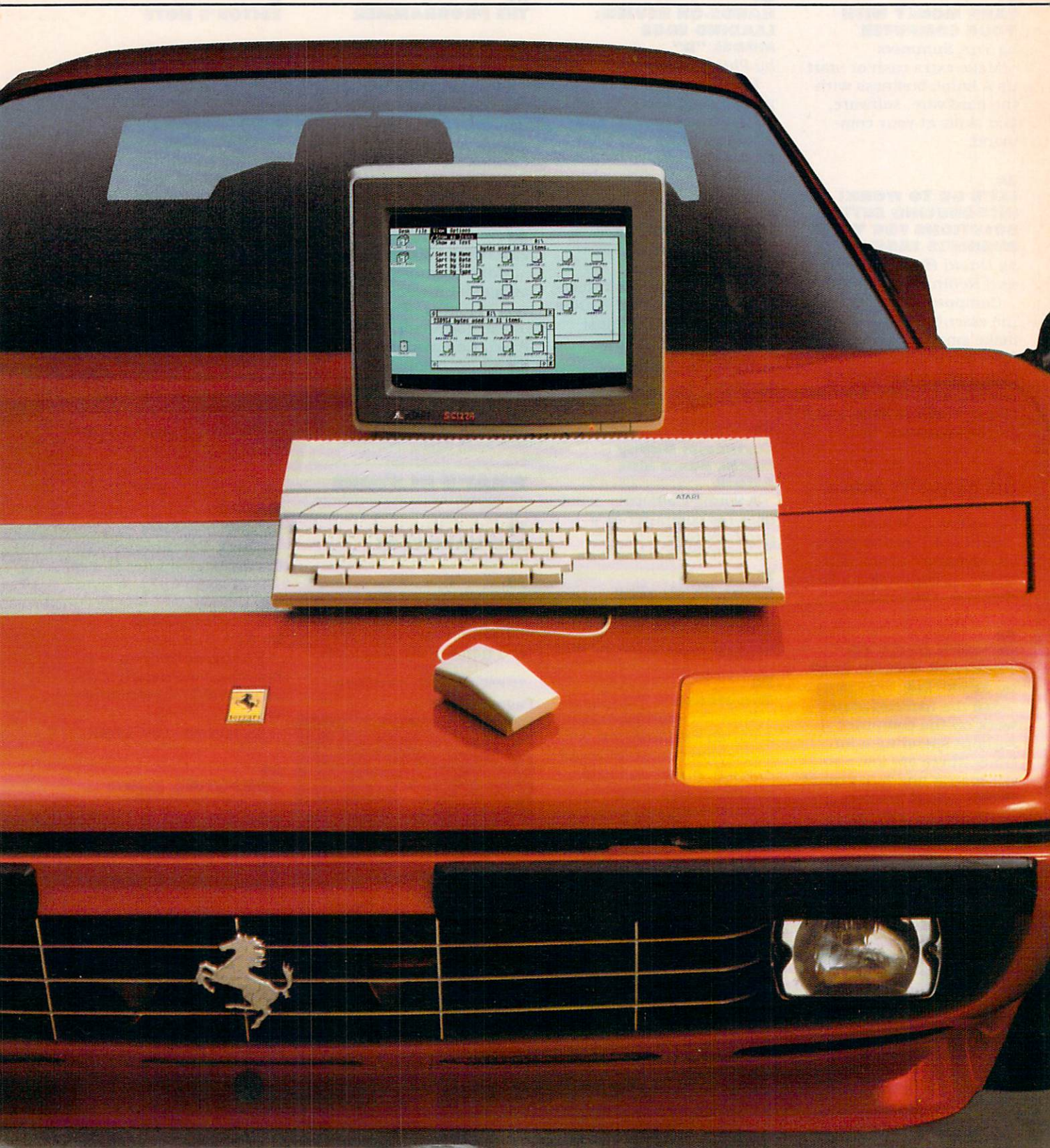
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	ATARI® 1040ST*	COMMODORE® AMIGA™	IBM® PCAT™	APPLE® Macintosh™	APPLE IIc®
Price	$999	$1795	$4675	$1995	$1295
CPU Speed MHz	68000 8.0	68000 7.16	80286 6.0	68000 7.83	65002 1.0
Standard RAM	1 MB	256K	256K	512K	128K
Standard ROM	192K	192K	64K	64K	16K
Number of Keys	95	89	95	59	63
Mouse	Yes	Yes	No	Yes	Optional
Screen Resolution (Non-Interlaced Mode) Color Monochrome	 640x200 640x400	 640x200*** 640x200***	 640x200 720x350**	 None 512x342	 560x192 560x192
Color Output	Yes	Yes	Optional	None	Yes
Number of Colors	512	4096	16	None	16
Disk Drive	3.5"	3.5"	5.25"	3.5"	5.25"
Built-in Hard Disk (DMA) Port	Yes	No	Yes	No	No
Midi Interface	Yes	No	No	No	No
# of Sound Voices	3	4	1	4	1

Atari 520ST with 512K RAM, $799.

*Connects to standard color T.V. For RGB color monitor add $200.
**With optional monochrome board (non bit-mapped).
***Interlace Mode – 640x400.

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EDITOR'S NOTE

THE STORY BEHIND WHY I BECAME A CRAZED WOMAN

I get it. You get it. But here we are in our third year of publication and some people *still* don't get it. The "it" I'm talking about is the concept of "family computing."

Looking at our March issue with its IBM-compatibles cover, someone remarked to a colleague of mine, "Oh, you've become a productivity magazine." On other occasions I've heard, "Oh, yeah, you're basically a games magazine." Or how about, "You cater to kids."

All true! Always! From the beginning. From our very first issue in September 1983, FAMILY COMPUTING's editorial coverage has catered to adults managing family affairs (and *even* working at home) with a microcomputer; we've included a healthy dose of fun (and games) for computer users of every age; and we've paid close attention to the educational benefits of using a computer, especially at home.

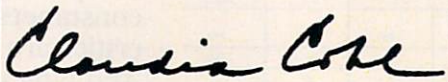
That triple crown tells the story. Family computing brings it all together. At home, away from the pressures of school or work, there's time to expand one's use and knowledge of the computer, time to get a project done away from the inevitable interruptions at the office, time to help one another solve various computer-related problems, and time and reason to get together for a little family relaxation, a little cooperation, and a little competition—at the computer.

The emphasis might be more on one use of the computer over others, or it might swing from one to the other, but in tens of thousands of households, the computer (or often computers) is used for a broad range of applications.

It's *only* at home that the microcomputer is put through its paces and gets a workout that allows it to show its prowess as a workhorse, a manager, and a source of entertainment. It's only at home that parents and kids—adults and children—all turn to the computer to meet their sampler of needs.

At FAMILY COMPUTING, the editors are concerned with balancing each issue to cover all these needs. That balance is evident on our contents page and in our articles and reviews, and is a major discussion topic at every editorial meeting.

The idea of "family computing" seems so obvious to me and it must be obvious to you, because we've now gone beyond the 410,000-circulation mark (beyond the 1.7 million adult readers and 1.3 million teens) I last talked about, and we're still climbing. You'd think it wouldn't matter to me if one person here or there didn't get it, but then again . . . Now you know (at least in part) the story behind why I became a crazed woman.



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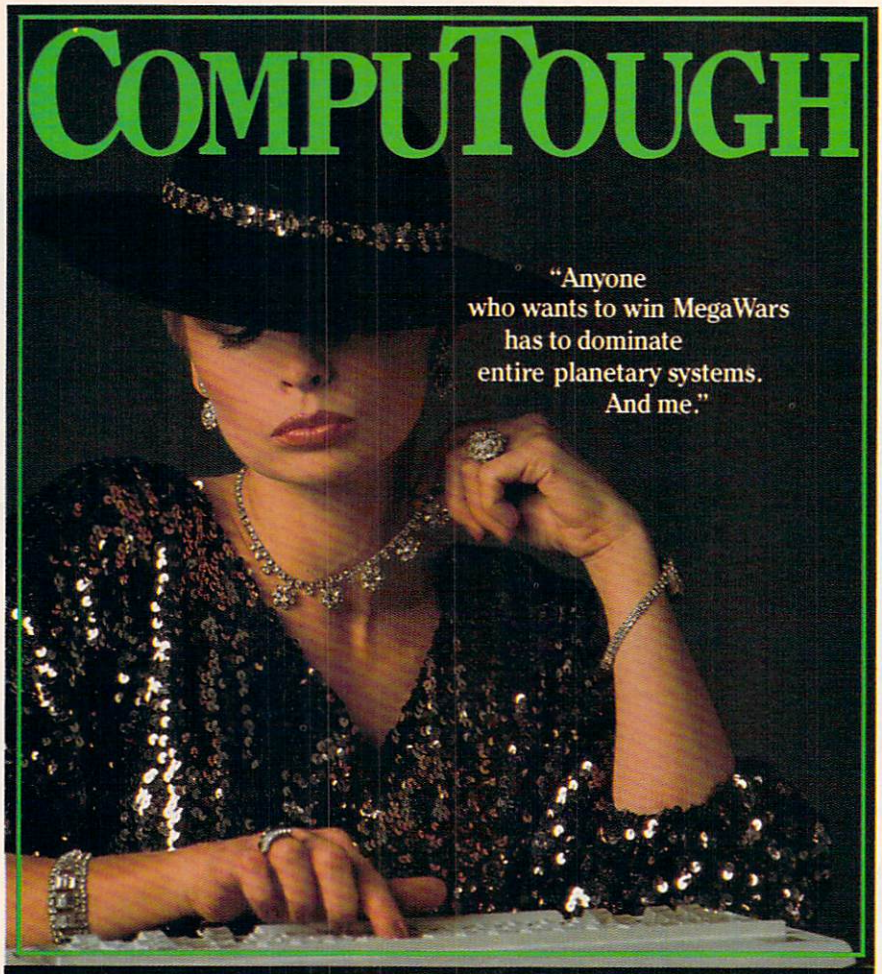

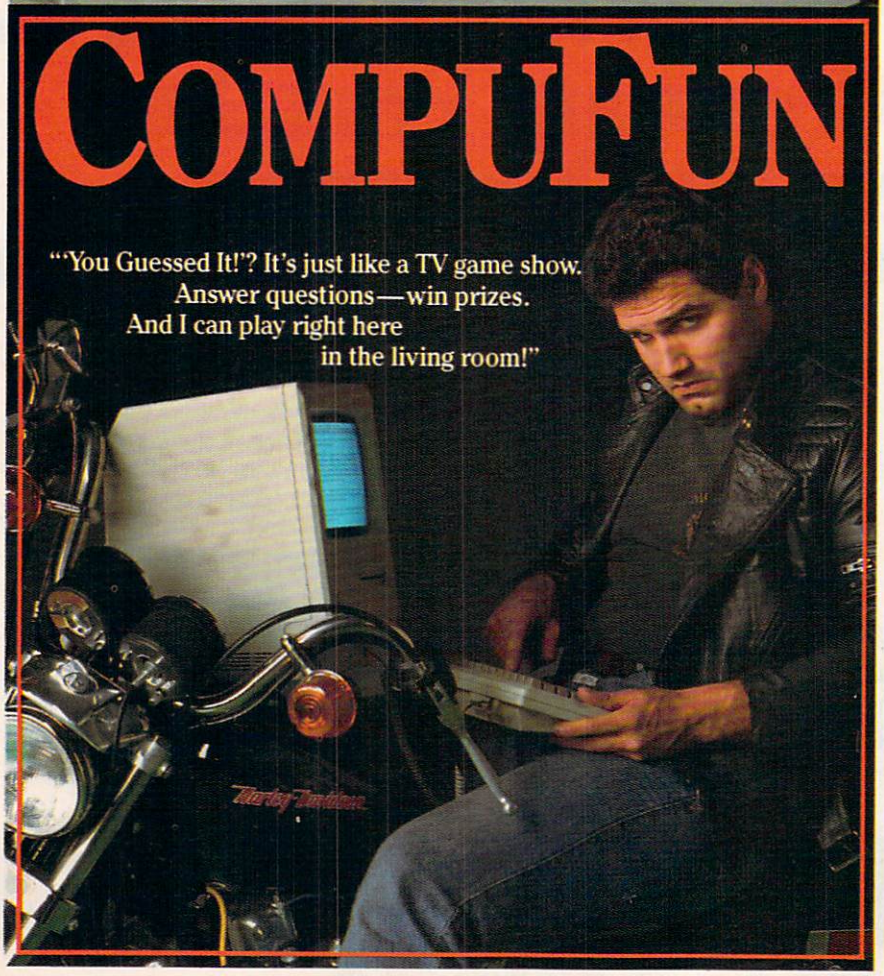

LETTERS

NEW AT&T-COMPATIBLE MONITORS

The "Buyer's Guide to IBM-compatible Computers" in the March issue was very informative. I enjoyed reading the entire article, but I was quite surprised when you claimed that "you can't use any other" monitor with the AT&T PC.

My company, Taxan Corp., has been a major supplier of the high-resolution 630 and 640 RGB monitors to AT&T distributors. We are AT&T-approved, and our monitors have been packaged with the 6300 and 6300+ by the hundreds since November 1985.

I always read FAMILY COMPUTING and I value your articles, but, in this one instance, I would appreciate your correction of this oversight.

CORINE GERSCHBACHER
Marketing Specialist
Taxan Corp.
City of Industry, California

EDITOR'S NOTE: *We're glad to have this opportunity to bring these new AT&T-compatible monitors to our readers' attention. When the article was being researched, the AT&T official we contacted didn't know that Taxan's 630 and 640 monitors were on the market. For information on the Taxan monitors, contact the company at (818) 810-1291, or write to 18005 Cortney Court, City of Industry, CA 91748.*

FAMILY COMPUTING *has also learned of another newly released AT&T-compatible monitor, by Tatung Co. of America, Inc., 2850 El Presidio St., Long Beach, CA 90810; (213) 637-2105.*

AMIGA TAKES MAC PROGRAMS

I have subscribed to your magazine for more than a year and enjoy it very much. At first, I never paid much attention to the programs you printed because it was such a chore to type them in, and then to identify and correct my inevitable typing errors. However, I recently purchased an Amiga, which makes the task much easier.

I have also found that some of your Macintosh programs will run on the Amiga without any modifications. I ran the *Jingle Bells* program from your December issue, the *Aver-*

CIRCLE READER SERVICE 12

aging program from your February issue, and the *Baby Box* program from your January issue.

Keep up the good work.

DAVID B. JOHNSON
Baton Rouge, Louisiana

LETTER-QUALITY FOR LESS

I would like to see some technical articles on the Tandy 1000 and Atari. I believe these systems should be evaluated with a specific printer and compared to similar systems or computers. We still need a printer for our small business, and we don't know which would be best for us. We need letter-quality at minimum cost.

W.C. LILLY
President, Marine Associates
Washington, D.C.

EDITOR'S NOTE: *You're in luck! Turn to page 40 to our "Buyer's Guide to Printers Under $600." On the chart, you'll find specifications for daisy-wheel printers with a parallel interface for your Tandy 1000. For the Atari, the Atari 1027 is a low-cost letter-quality printer for the XE/XL line that you might be able to find in electronics outlet stores.*

CORRECTION

For readers trying to reach Computer Easy, publishers of the *PC File* program (mentioned in the chart on page 32 of the March issue), the correct telephone number is (602) 829-9614.

The "Buyer's Guide to Graphics Software" in the February issue incorrectly listed the number for LCS/Telegraphics. They can be reached at (617) 547-4738 or (800) 437-0036.

FAMILY COMPUTING *looks forward to letters from all our readers. Please direct your correspondence to: Letters to the Editor,* FAMILY COMPUTING, *730 Broadway, New York, NY 10003. Include your name, address, and telephone number. We reserve the right to edit letters for length and clarity.*

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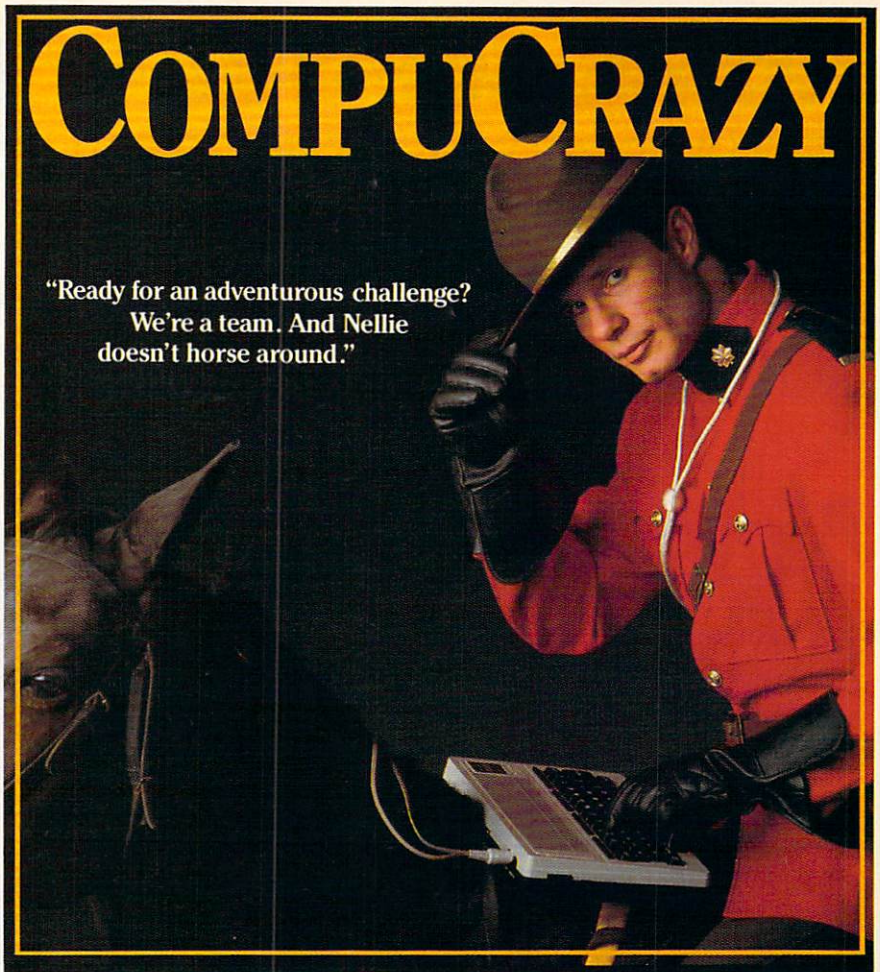

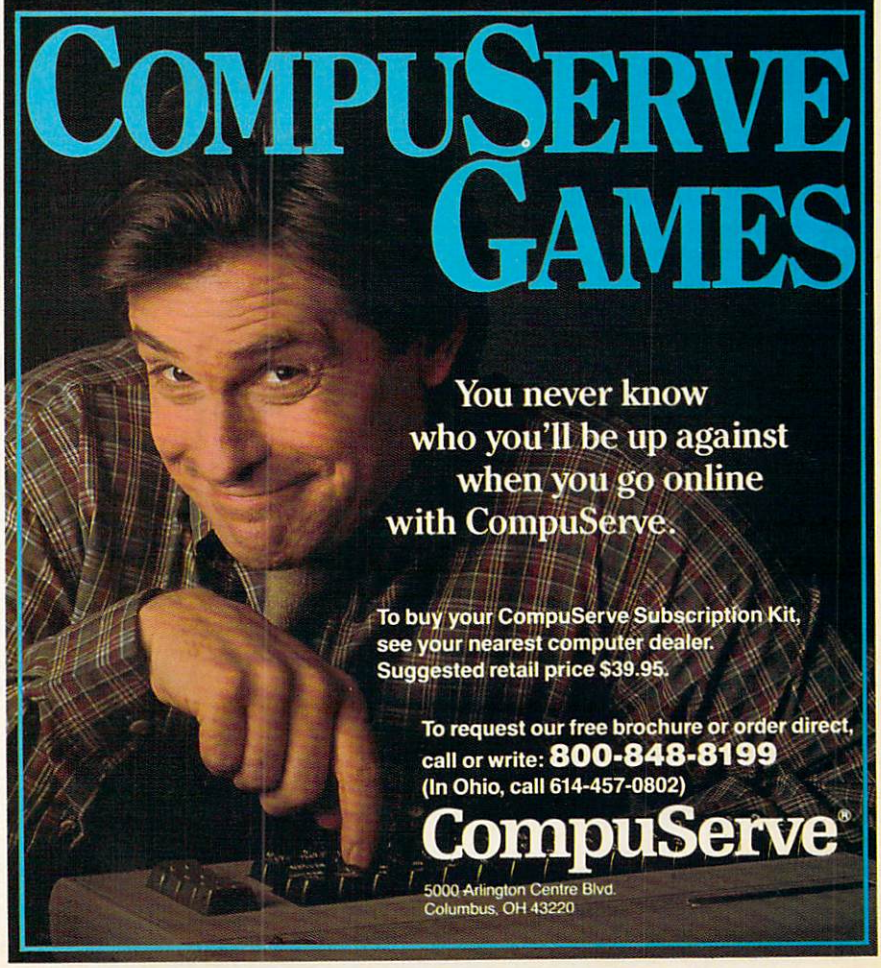

HOME-SCHOOL CONNECTION

HELP STUDENTS AND SENIOR CITIZENS BECOME COMPUTER PALS

How Your Community Can Unite Two Generations

BY LINDA WILLIAMS

Sukhmeet Singh, 12, introduces a senior citizen to the world of computers.

Dear Family and Friends: Happy Holidays! I'm in computer class now. I'm writing this with Bank Street Writer *and* The Print Shop. *My teacher is 11 years old . . .*

Relatives and friends of 74-year-old Elizabeth McNellis weren't that surprised last Christmas when they received her computer-printed note, decorated with wreaths and fir trees. "They weren't amazed that I had learned about computers," explained McNellis. "Everybody knew that I wanted to learn about them. But they *were* amazed that 11-year-olds were my teachers!"

McNellis is just one of a dozen senior citizens attending a free monthly computer literacy program taught by middle school students at Roycemore School in Evanston, Illinois. For the elderly participants, the program, called Computer Pals, is more than a monthly activity; it's a chance to interact with younger people and to benefit from their expertise and experience in a new field.

"People 60 and up have seen more technological change in their lifetimes than any other generation has," said Libby Hill, the Roycemore librarian who initiated Computer Pals last spring. "We're trying to provide one-on-one instruction so they can experience what it is that's making a difference in their lives today."

LINDA WILLIAMS *frequently writes on the subject of computers. She wrote "Technology With a Heart" in the December 1985 issue of* FAMILY COMPUTING.

HOW EVANSTON'S SENIOR CITIZENS AND STUDENTS TEAMED UP

Hill conceived of the program after a meeting of Evanston's Intergenerational Task Force in January 1984. The group thought the senior citizens were becoming isolated from the community and were losing sight of what their tax dollars help provide for schoolchildren. "I thought of computers as a way to bring these people together," Hill said.

She spoke with school authorities about using the computer lab for the program, and enlisted a group of computer-savvy 11-, 12-, and 13-year-olds who were willing to volunteer their time and share their knowledge. One of the tutors, 12-year-old Sukhmeet Singh, said, "I thought,'I have computer expertise and I like old people, so I might as well give it a shot.'"

Through sign-up lists posted in retirement and senior-citizens' activity centers, Hill found a community full of people curious about the computer revolution. Most of the participants had computer-literate friends or relatives, but didn't have the opportunity or courage to try their own hands at the machines. Some had considered computer courses, but decided they were too far away, too late at night, or too much money. The news of a free introduction to micros certainly was welcome.

On the first night, all of the senior citizens were stepping onto unfamiliar ground. "When I first got there, it was a mystery to me," McNellis admitted. Yet, she added, with her young personal tutor, she quickly mastered *Bank Street Writer* (Broderbund). "I was a typist in my early years, so I was familiar with the keyboard," she continued. "Now I know how to correct my mistakes."

The children were also plunging into a new field: teaching. To be the best teacher possible, Singh put

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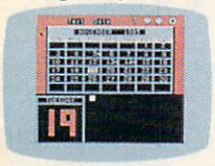

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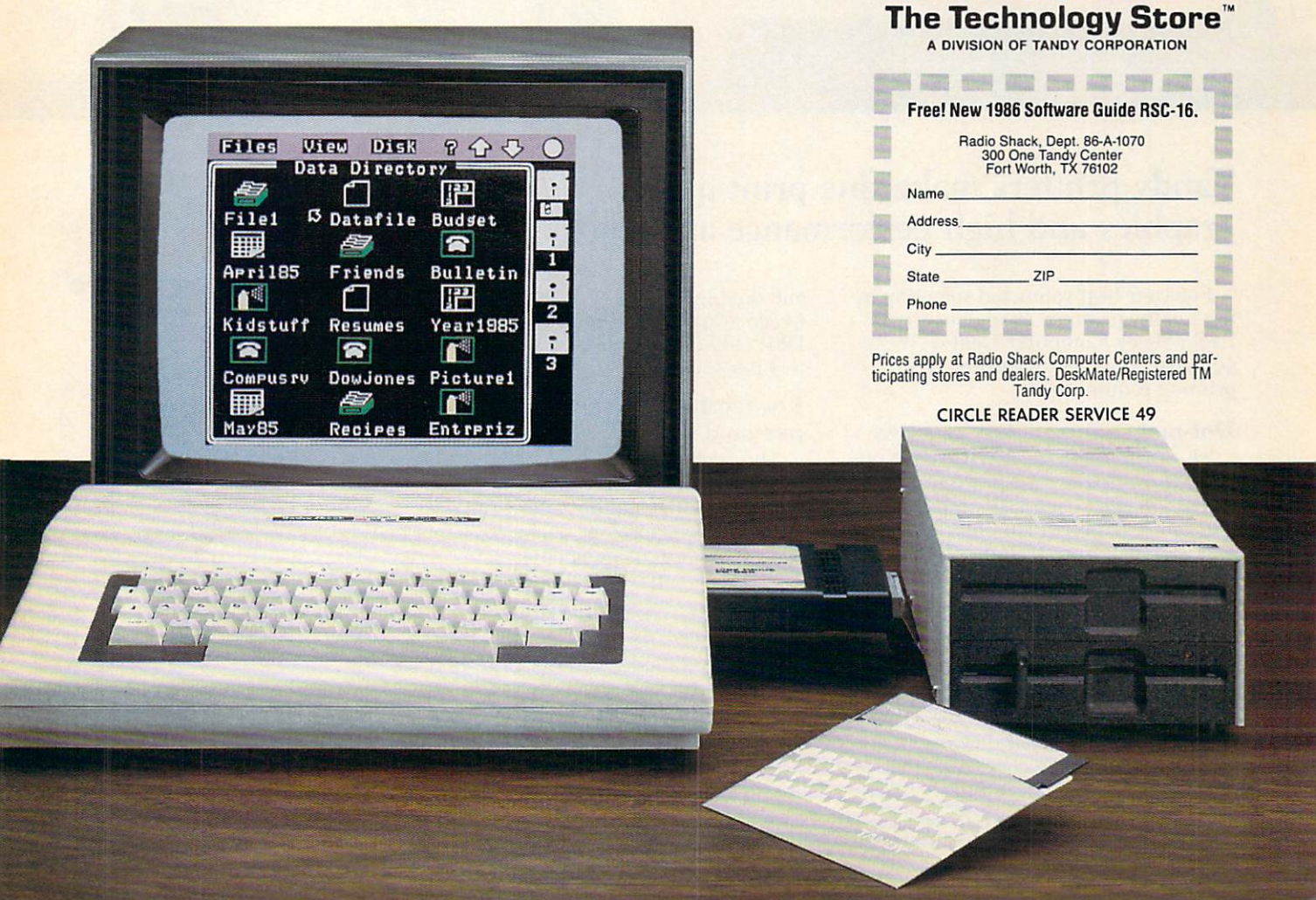

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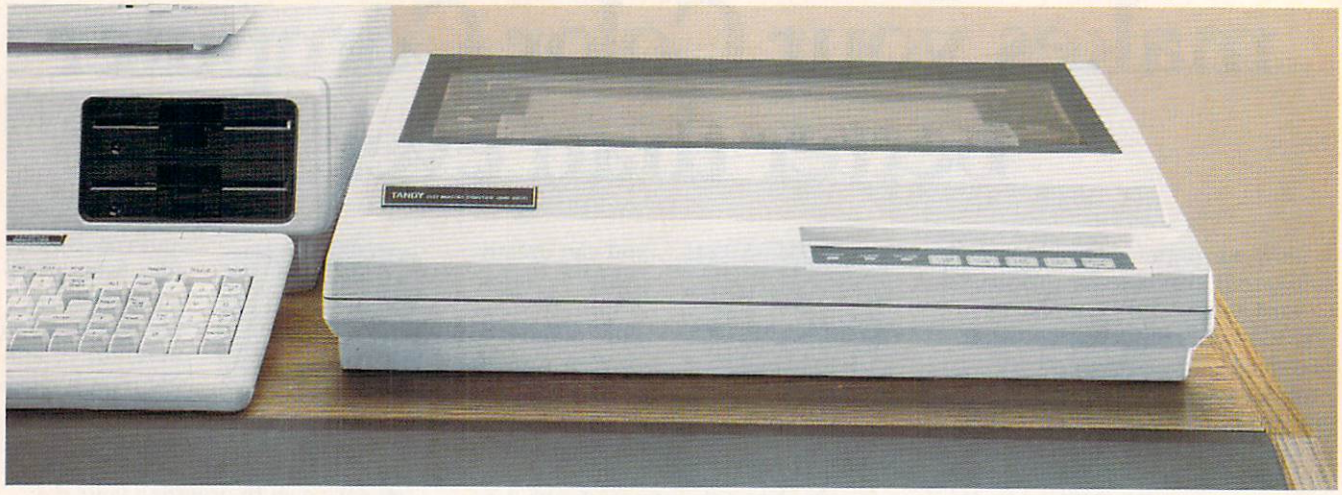

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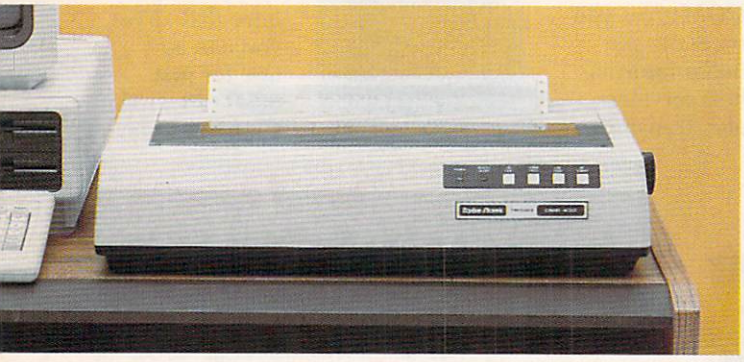

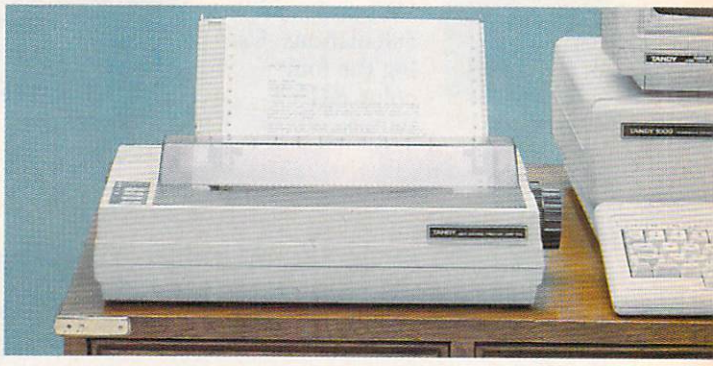

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CIRCLE READER SERVICE 50

himself into his students' shoes. "I just thought to myself how I started at the computer and how I would feel if I was just starting out now," he said. "The first time (the senior citizens) were a little too much afraid. I just tried to tell them that they couldn't do anything to break the computer."

BRINGING COMPUTER PALS TO YOUR TOWN

There are bound to be senior citizens in your community like Elizabeth McNellis and many others, who grew up long before a computer revolution was in sight. Unfortunately, it's unlikely that your town has a Computer Pals program. Whether you're a teacher, the parent of a computer-literate child, the friend of a senior citizen, or a senior citizen yourself, you can start up a similar class in your own community. Here's how:

Select a School. Look for a school or community center with a well-equipped computer lab. The lab should include about 10 computers, three printers, and enough space for the senior citizens, 10 tutors, and at least two adult supervisors. Consider the location: Is the school near public transportation? Is the neighborhood safe? Is the lab on the ground floor or reachable by elevator? (Climbing stairs is difficult for many elderly people.)

Enlist a School Sponsor. You'll need to initiate a relationship with a computer-savvy authority at the school. Your best bet may be to work through a parent-teacher association. The sponsor can help with such details as obtaining permission to use the computer lab, ensuring that the building remains open on afternoons, and preparing the school for expenses, including computer paper, software, and electricity. In addition, the sponsor can help you select a team of tutors.

Locate a Community Liaison. This person can work with school authorities, if necessary, to assert the value of the program, and be your link to the community's elderly. The liaison—particularly if he or she deals primarily with senior citizens—will know of outreach programs, activity centers, and retirement homes teeming with prospective participants.

Define Qualifications for Participants. As Libby Hill explained, "You need a body of senior citizens who are mobile and interested in current topics. They have to show initiative: They have to call and R.S.V.P. every time, and get there on their own. It takes some guts for a senior citizen to go out and do this."

Recruit Tutors. Ask the school sponsor to post a notice of a meeting for prospective tutors. Candidates should be familiar with the school's equipment and have an abundance of patience and enthusiasm for computing. Hill found junior-high students a good age for tutors, since they've had computer experience at school, but aren't yet tied down with part-time jobs.

Meet With the Tutors. Hold a meeting one afternoon, outlining the program and its goals, and making a list of students' favorite software (to get an idea of who can teach word processing, Logo, graphics, etc.) The meeting should be immediately after school, so students don't have to venture out at night. Have the students write down their after-school activities, so you can work around meetings, play rehearsals, and athletic team practices.

Find Senior Citizens. Draft an enticing, informative notice and a sign-up sheet to post in the senior citizen areas. (Your community contact can help with this.) Make it clear that the program is a free (or inexpensive) introduction to computers, but that participants will need to get to the school on their own. Be sure to provide your phone number, and perhaps those of the school sponsor and the community liaison, as the senior citizens may have questions.

Send Friendly Follow-Ups. After the notices have been posted for at least a week, retrieve the sign-up sheets. Send each person a computerized invitation/reminder two weeks before the first session, and every session thereafter. As Hill explained, "This is an important link to the outside world. The seniors love to get mail. They love to call me and R.S.V.P. Some of them are apprehensive; they need reassurance that they'll be able to do it, or that it's okay to miss a session."

Select Simple Software. Make sure the school has a good selection of easy-to-use software, including word-processing, graphics, and educational programs. Hill noticed particularly good reactions to *Bank Street Writer*, *The Print Shop* (Broderbund Software), and Logo soft-

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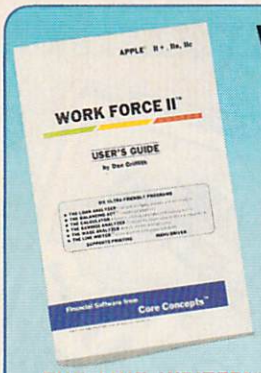

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HOME-SCHOOL

ware. Be sure to match up tutors with software.

Plan to be an Early Bird. Make sure you—or someone else—can be on hand well ahead of class time to greet the participants. Hill warns that elderly people are apt to arrive early. For some, it's the highlight of the week. The host should help each senior make a name tag and ease the precourse jitters. Ensure that the participants can wait comfortably until tutors come.

Remember Details, Details, Details. Make sure all of the programs and the machines you intend to use function properly. The senior citizens will become frustrated and discouraged if the machines break down, and the young tutors will get nervous and confused if their class is in disarray.

Give Positive Feedback. Help the seniors realize they've accomplished something. Plan for each of them to make one computer printout at each session. It could be a word-processed letter, a graphic design, a cute card, etc. The key, Hill found, is for each participant to leave with something in hand.

Anticipate Problems. Be ready for slight mishaps with the sessions. Problems Hill has encountered include: too few senior citizens (the tutors get discouraged when they don't have students), bad weather prohibiting participants from attending, seniors signing up and not attending (or attending without signing up), and participants mixing up the dates. "We had one woman who came on public transportation a week early on a cold, rainy day," Hill recalled. "I felt so bad for her that I drove her back in my car."

SUCCESS AT EVANSTON

Problems, however, have been rare during the sessions at Roycemore School; the tutors and senior citizens exchanged verbal gold stars. "My little teacher was so good, she taught me just what to do," McNellis raved. "It's just wonderful to think that they're so competent at that age. And I don't think an adult teacher would have been so attentive."

Another student, 68-year-old Bertha McDay added: "With the kids helping, I don't think that it's hard. I thought that if I can learn how to do it, maybe I'd like to have a computer. Maybe I'll buy one, if they're not too expensive." FC

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CIRCLE READER SERVICE 29

HOME/MONEY MANAGEMENT

HOME-CONTROL SYSTEMS
Control Your Lights, Appliances, and Heaters To Save Energy and Keep Your Home Secure

BY LESTER BROOKS

Envision yourself lounging on a sofa in your family room, thinking about going to bed, but first pushing a button to turn up the heat in the bedroom. Or, how about calling your empty house before you leave work and telling the microwave to start cooking?

A decade ago this was the stuff of science fiction. A few years ago it was the province of techno wizards. Now, though the idea perhaps sounds more glamorous than real, home control is beginning to make sense for the rest of us.

"Basically, I use my computer to turn anything on or off that is electricity-driven in my home," says F.S. Zazueta, an agricultural engineering professor at the University of Florida. "I use it to water the lawn and turn on and off lights, TV, stereo—things like that."

Zazueta puts his computer to work saving energy, taking care of routine chores, and giving the house a lived-in look when the family is away. Zazueta, his wife, and their two children (a boy and a girl, 10 and 11 years old) live in a modest, four-bedroom, ranch-style house in a residential area of Gainesville, Florida.

Five years ago, when he first put his computer to work, Zazueta was one of the early birds of home control. He used standard, off-the-shelf hardware, but had to write his own computer program. That took a couple of weeks. Today, he is quick to point out, it's much easier, quicker, and cheaper to set up and use a home-control system, and it doesn't require any special training. You can buy both the hardware and the software off the shelf in one package. In many cases, you don't even need a computer; you can set timers on a control unit and plug it into any electrical outlet.

ZAZUETA'S ZENITH

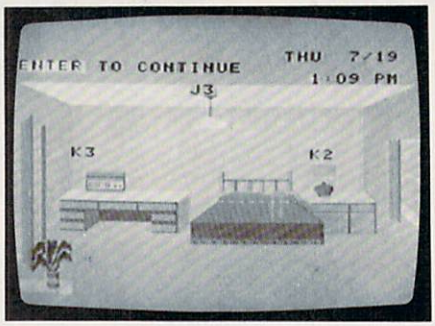
Zazueta's Zenith computer controls his lights, TV, and stereo, and waters the lawn and garden when necessary. The controller turns off the lights in the children's bedrooms at a set time each night (depending on the hours of daylight), and doesn't allow them to be turned on again until the following day, unless the manual override feature is used. Because the kids have grown up with computers, they consider home control normal, says Zazueta.

In the parents' bedroom and in the kitchen and living room, lights, TV, and stereo click off at bedtime (11 p.m.), but may be turned on manually. Every half-hour the home-control system sends a signal to turn the lights off. "If you happen to go to the kitchen for a drink of water, you can turn the light on and after a few minutes the machine will turn it off, but you can always turn it on manually," says Zazueta. "You have half an hour leeway."

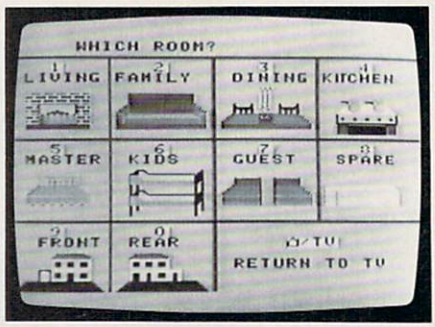
The purpose of such control? To cut down on the use of electricity during daylight hours. Zazueta modifies the schedule as daylight hours change.

The most unusual feature of Zazueta's system is his lawn-and-garden-care program. Pop-up sprinklers supply water through five electrically controlled valves when needed. Meters in the soil measure dryness and notify the computer when water is necessary. The computer turns on the valves for a precalculated period of sprinkling.

When the family leaves the house for short holidays, Zazueta replaces the everyday software schedule with a special vacation security schedule that simulates the normal pattern of lights, stereo, and TV usage (turning the TV on and off). The sprinkling system continues to operate "on demand."



The GE HomeMinder has a simple, step-by-step setup process. Here, the light and appliance modules are numbered K3, J3, and K2.



The X-10 Powerhouse ($70 for controller, cable, and software) controls lights and appliances plugged into the various modules.

HOW HOME CONTROL WORKS

You can control your lights and appliances, water heater and central heating, air conditioning, security alarms—anything that uses electricity—with your computer. You can set any electrical device to turn on or off (or dim or brighten) on an appointed schedule. For instance, you can tell electrically controlled drapes to close at dusk and open at sunrise to save on heat costs in your home. But you can't change channels on the TV, or control the volume on a stereo.

In some cases, you can use heat, light, moisture, or motion sensors to trigger an on–off signal to an electrical device. For example, you can have a motion sensor detect an intruder's presence and set off flashing lights or sirens.

You don't have to install any wires, because the control signals are transmitted over your existing electrical-wiring system. You merely install X-10 modules (about $18 each) in outlets; the lamps and appliances you want to control are then plugged into these compact devices.

Besides these modules and your computer, you need a "controller"—X-10's Powerhouse controller is an economical choice—that gives "on"

LESTER BROOKS, *coauthor of* How to Buy a Condominium *(Stein & Day, New York, 1975), wrote "Automatic Pilot" in the December 1983* FAMILY COMPUTING.

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and "off" or "dim" instructions to the modules. This controller is also plugged into any electrical outlet.

Where does the computer fit in? You use your computer and commercial software to set the timing schedule for your lights and appliances. The newest home-control software—used with the X-10 Powerhouse—is very graphic. You use a mouse, joystick, keyboard, or infrared controller to "place" lamp and appliance symbols on a room-by-room floor plan of your home. You type in the time of day you want each lamp or appliance to turn on and off. The controller, connected to the computer's RS-232C serial port, records all this information.

Once the schedule is satisfactory, you can unplug your computer and the controller will run the scheduled "events." You can override the schedule manually, as Zazueta does. At any time you may reconnect the controller to your computer and modify your original schedule, or change disks to another schedule you have programmed—perhaps for vacations or weekends.

For this typical control system, your costs (over and above the price of a computer) might be about $250, priced as follows: X-10 Powerhouse Controller and software ($70–$80); 10 modules at $18 each ($180).

However, you can operate some home-control systems without a computer. (*See "Home-Control Products," below.*) Some control systems, such as the X-10 Telephone Responder and GE HomeMinder, can be given messages through the telephone, so you can call home when leaving work and key in a code to turn on the heating or air-conditioning system.

NEW HOMES ARE AUTOMATED

For people who want the advantages of home-control systems without the fuss and bother of doing it themselves, some companies will install customized home-control packages. However, most of these systems won't work from existing house wiring, but require heavier cables, and are thus best suited for new-home construction.

Leviton's Home Control and Central Control Systems, for home and industrial use, are sold and installed only by electricians. The system is hard-wired into the house so that no modules are needed. Both the Leviton system and the Jance Automated Home System are designed for energy efficiency, and will make sure that several heavy-duty appliances don't run at the same time, which may create a surcharge.

Some home builders are including control devices in new units. Ryan Homes in Pittsburgh installed several thousand HomeMinders from General Electric in new homes. In addition, NAHB Research Foundation is trying to develop a revolutionary, "one-cable-carries-all" house-wiring system. One cable will carry electric, telephone, TV/radio, audio, computer, and control signals. The association is now building its first "Smart House" models.

If builders are incorporating home control into new houses, and TV manufacturers (such as General Electric) are beginning to do the same with TV sets, what started as a gimmick for technically-minded computer owners may eventually be taken for granted by home owners. FC

HOME-CONTROL PRODUCTS

COMPUTER-CONTROLLED

The X-10 system is the standard for all home-control systems. In fact, many systems sold under other names are manufactured by X-10 (USA) Inc, formerly BSR X-10. And virtually all home-control systems on the market require the X-10 modules to control lamps and appliances.

X-10's Powerhouse Computer Interface ($70–$80, including software and cable) is available for the Apple IIe/IIc, Commodore 64/128, IBM PC, and Apple Macintosh.

The Tandy Appliance/Light Controller ($99.95) is designed to be used with the Tandy Color Computer. Plug 'n Power modules (the same as X-10 modules) are available at Radio Shack stores for $17.

The Sears Home Control System, with modules, is basically the same as the X-10 system under the Sears name.

For those willing to assemble their own hardware, Heathkit offers the Smarthome I Controller in kit form ($299.95, plus $99.95 for software). A no-frills controller is Heathkit's Interface Kit ($99.95) which fits any RS-232C serial port, but lacks the easy on-screen programming and software features of the X-10 system.

Jance's Automated Home System ($250 without computer) is designed to conserve energy costs by running appliances late at night when rates are lower. It also limits appliance use to a specified number of watts to prevent utility company surcharges, and prevents appliances from heating up or cooling down too quickly.

COMPUTER-INDEPENDENT

CyberLYNX's Smarthome I ($720) is basically an X-10 system that doesn't require a computer, but controls only 10 modules. You can add a security system ($680) to Smarthome, and use window sensor modules to detect burglars.

General Electric's HomeMinder with infrared remote transmitter ($500), which works through any TV set and doesn't require a computer, uses X-10-style modules to control electrical items. You can switch from TV-watching to home-controlling or set the schedule in different rooms by pushing buttons on the infrared remote-control unit. One new 25-inch GE TV set ($1,200) has a HomeMinder unit built into the set along the top. The HomeMinder can also be controlled with a touch-tone telephone.

Mastervoice's Butler In A Box ($1,195) is a stand-alone control unit that uses X-10 modules and has voice-recognition capability. Sidney, as the "butler" is called, can be programmed to recognize up to four human voices. You can command Sidney to turn off the radio, dim the lights, turn on the Jacuzzi, or do any of the 32 chores you've taught him to do. Butler In A Box also has an automatic timer (when you're not around to talk to it), and can be used as a two-way speaker phone that will dial a preprogrammed number on command.

X-10's Powerhouse Technology Sampler ($25) is an eight-unit manual controller that operates without a computer. You can control up to eight lights and appliances from one location with the push of a button. One module is included. GE's MiniMinder Controller ($40) performs the same functions.

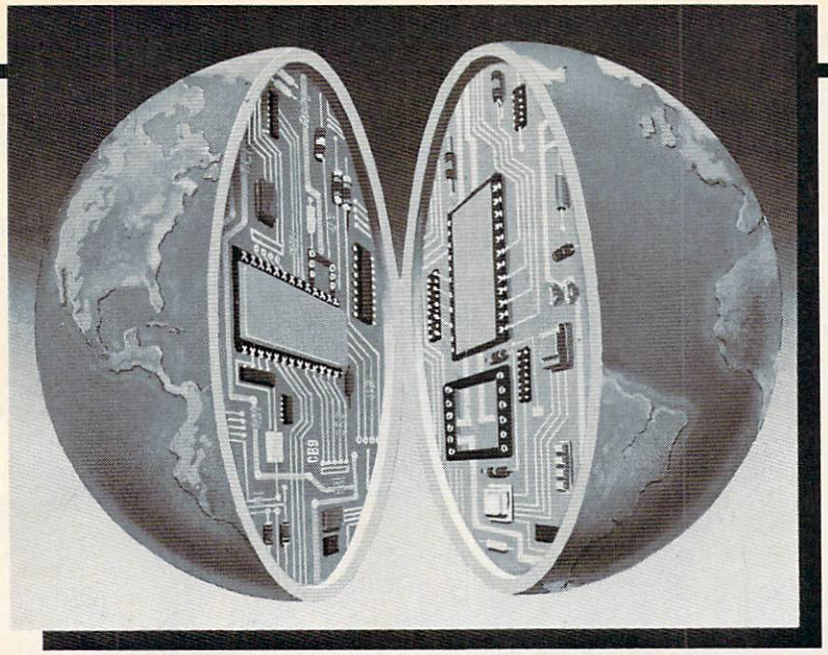
The X-10 Time Console ($40) automatically controls up to eight lights or appliances. The Telephone Responder/Controller Set ($50) is similar, but can be connected to and controlled by telephone.

MODULES

The basic X-10 lamp and appliance modules (also sold by Tandy as Plug 'n Power modules, and by Sears as part of the Sears Home Control System) cost $18–$30. The GE HomeMinder modules cost $30–$40. The Thermostat Controller Set, to control furnace or air-conditioning thermostats, sells for $40. The Burglar Alarm Interface/Controller, which will turn lights or appliances on when the alarm is sounded, costs $40. The Alarm Interface can also be used with other sensors to set off reactions. For instance, a motion sensor might turn on the lights in your home when you enter the front door.

HOME-CONTROL MANUFACTURERS

CyberLYNX, (303) 444-7733; General Electric Co., (804) 483-5037; Heath Co., (616) 982-3210; Jance Associates, Inc., (215) 398-0434; Leviton Manufacturing Company (718) 631-6555; Mastervoice, (213) 594-6581; Tandy Corp., (818) 390-2728; X-10 (USA) Inc., (201) 784-9700.



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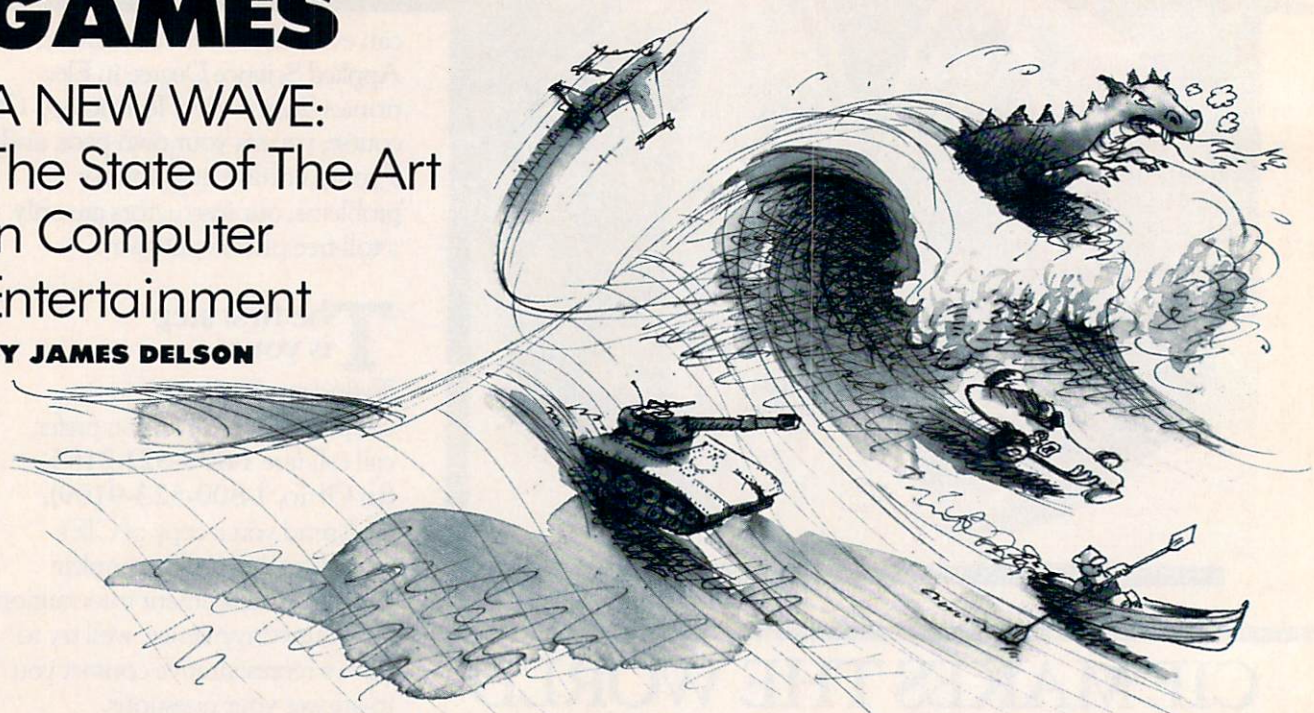
CIRCLE READER SERVICE 9

GAMES

A NEW WAVE: The State of The Art in Computer Entertainment

BY JAMES DELSON



A lot has happened in the computer entertainment field since this time last year. The big news includes the introduction of new types of entertainment programs and graphic packages. Also of note: new hybrids growing out of two or more established genres. While of lesser impact, sequels that appeared during the past year refined existing play systems, graphics, and character creation.

A GARDEN OF GRAPHIC DELIGHTS

Computer graphics have come a long, long way since the Stone Age visuals of Pong a decade ago. Of all the advances in the past year, the most breathtaking were the graphics for the Epyx/Lucasfilm program, *Ballblazer*. With the seamless animation of a cartoon, the game's visuals struck anyone I know who saw them as the most sophisticated computer graphics yet. (The game, unfortunately, became boring after repeated play.)

This year's first program from Epyx/Lucasfilm, *The Eidelon*, is another visual knockout. It delivers more great graphics, and generates a series of endless underground caverns to explore. Kids tend to like it more than adults do.

ADVENTURES MADE FOR EVERYONE

Despite the popularity of adventures, whether text-only or text/graphic, some gamers still feel they're not their style. One complaint is that it's too difficult to solve all those puzzles. Another is that it's tiring to have to use the precise words or phrases necessary for the computer to acknowledge commands.

We played three games this past year that go a long way toward eliminating those gripes: *Law of the West*, *Escape*, and *The Cave of Time*. All are joystick-controlled, text/graphic adventures with some arcade features. In each, instead of having to work out *how* to tell the computer to do something, all you need to do is choose the correct answer from a multiple-choice list. With wide varieties of situations, and different outcomes from each answer, the games' play systems are real advances in making adventures more accessible to a larger audience.

Other firsts in 1985 were true role-playing adventures set as text/graphic games. In *Shadowkeep*, for one, groups of adventurers could walk down halls, open doors, fight animated monsters, and change positions with other characters in a fight—all in full-color, wraparound graphics. Nonfantasy fans appreciated *Wilderness*, an outdoor survival adventure with 360-degree wraparound graphics and add-on terrain disks for years of gaming pleasure.

CUSTOMIZE WITH CONSTRUCTION SETS

The news about construction sets for the past year: there were more and more available, and in a wide range of genres, too. From sports (*Fast Tracks*) to arcade/role-playing (*Mail Order Monsters*), and from strategy and tactics (*Under Fire*) to build-your-own games (*Garry Kitchen's Game Maker*), this is one hot genre. (*Watch for an upcoming feature on construction sets in the July issue of* FAMILY COMPUTING.)

HYBRIDS PUMP NEW BLOOD INTO STRATEGY/ARCADE GAMES

For dramatic growth, this genre is the tops. Games like *AutoDuel*, *Moebius*, *Rogue*, and *Gemstone Warrior* have absorbed the influence of role-playing adventures, giving gamers the benefits of both: the arcade's fast-paced action *and* the character generation, questing, and mapping of traditional adventures. These hybrids offer devotees a chance to create a character, then see him or her through a series of hair-raising adventures—and be done in an afternoon, not the 200 to 400 hours needed to complete *Wizardry*, *Ultima*, or the like.

"Activity programs" have also risen to prominence. In these games, you control a variety of units and split your attention among them, while making sure each is working properly. The leading efforts in this area—*Countdown to Shutdown* and *Kennedy Approach*—are among the most complex games around.

SEQUELS: THEY'RE GETTING BETTER ALL THE TIME

Many sequels improved their original play systems last year, adding new options, more complex situa-

JAMES DELSON *takes a swing at sports games next month in* FAMILY COMPUTING.

ILLUSTRATION BY GARY HOVLAND

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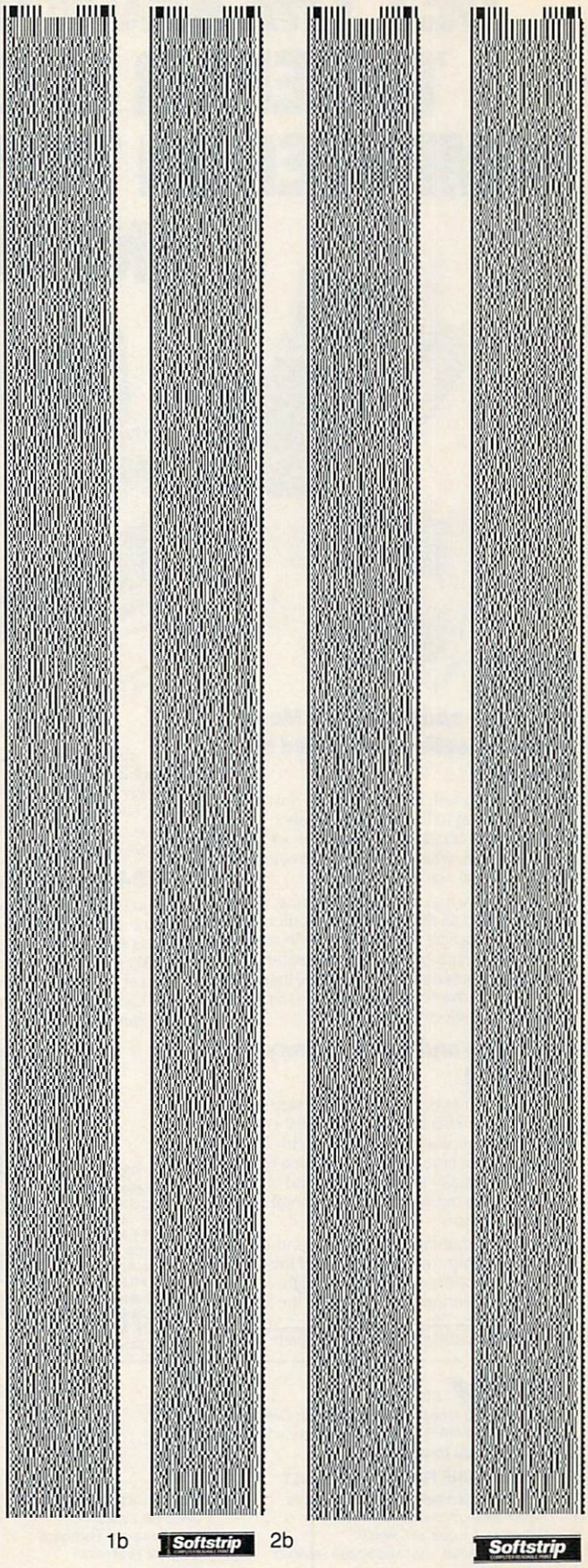
MAZE CREATOR will supply you with the flexibility and choice every devotee has been dreaming of. You'll have an inexhaustible supply of mazes for every member of the family. The difficulty level of each maze is up to the player. If you see yourself as an "expert" be careful. The blank maze, where the walls only appear when you hit them, could prove to be too much.

You have the choice of threading your way through your inventions on the screen or printing out your labyrinth and using the old standard—a pencil. You can use your keyboard, a joystick, or even a mouse to move through the maze. Play against yourself or someone else.

For Apple, read in the data strips (1a and 2a) and **RUN** the program. Follow the on-screen instructions. If you decide to change the size of the maze to be generated, press **RETURN** after typing the new height and/or width. Exit any time by pressing CONTROL-RESET.

For IBM, after you read in the data strips (1b and 2b), enter BASIC and run the program. Follow the on-screen instructions. If you decide to change the size of the maze to be generated, press **ENTER** after typing the new height and/or width. Exit any time by pressing CONTROL-BREAK.



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GAMES

tions to resolve, or better play balance. I'm thinking of *Archon II: Adept*, *King's Quest II*, *B.C. II: Grog's Revenge*, and *Spy vs Spy II: The Island Caper*. A new twist found in *Ultima IV* was dialog between the heroes and nonplayer characters.

Although add-ons to *Flight Simulator* have been slow in coming, they're finally here. A set of map disks can be used (with either the original game or the later *Jet*) to give players new scenery to fly over and operate in. *Jet* also expanded the simulator field by offering a "from-the-ground" point of view and a superior targeting process for air-to-air combat.

MASTERFUL ADVERSARIES AT LAST

Over the years, one of my pet peeves has been the lack of challenging electronic opponents in computer games. Now we've been seeing a series of games that provide not just one, but, in several cases, a *gaggle* of masterful computer adversaries.

In *Colonial Conquest* and *Incunabula*—two of the better games around—a variety of opponents with differing abilities, strategic doctrines, and experience levels can be taken on simultaneously. For computer foes as challenging as any I can remember, try playing *Balance of Power*, *Battle of Antietam*, *Carriers at War*, or *The Battle of Chickamauga*.

ADVANCING LINES IN WAR GAMES

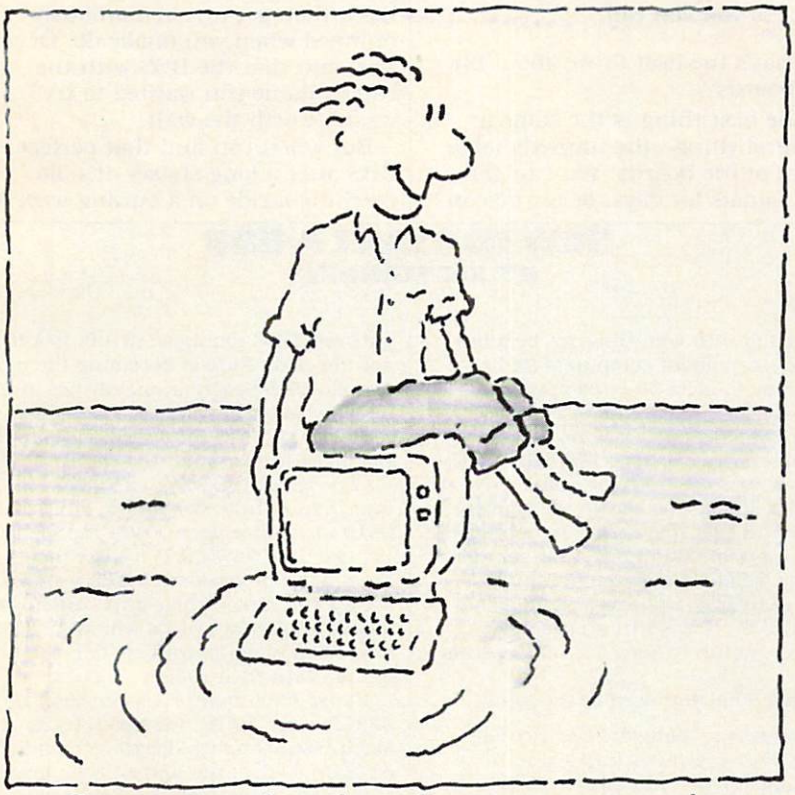
Greater "playability" has been the big breakthrough in war-gaming, particularly in *Chickamauga* and *Antietam*, mentioned above. Both work with every ability level by using improved play systems to control the units.

Going beyond the grand designs of the strategy-and-tactics genre, pure tactical war games focus your play on taking a town or bridge instead of a nation. Game designer Roger Damon has nearly monopolized this fast-moving new genre with three recent games: *Field of Fire*, *Panzer Grenadier*, and *Nam*.

THE NEWEST WAVE BREAKS

Exciting new directions are appearing under the guise of nongame, home-entertainment software. Two programs in particular—*Racter* and *The Little Computer People Research Project*—offer computer own-

GET YOUR FEET WET.



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Q. What's the best thing about bulletin boards?

A. The best thing is the same as the worst thing—the unpredictable nature of the boards. You can get busy signals for days, or get disconnect messages. You can waste five calls trying to sign onto a certain BBS, then get unceremoniously dumped when you finally do. Or you may find that the BBS with the catchy name you wanted to try wasn't worth the wait.

But when you find that perfect BBS after a long chase—it's like catching a ride on a curling wave. FC

HOW TO START A BBS

BY RIC MANNING

Starting your own BBS can be a fun way to learn about computers and a great way to meet other computer users. But if you do decide to become a sysop (systems operator), be prepared for some extra expenses and hard work.

My newsletter, *Bulletin Board Systems*, polled sysops across the country, and found that they spent an average of more than $3,000 to put their boards on-line. That estimate includes the price of their computers and modems. In addition, they spent an average of $50 per month to keep the BBS operating.

Here's what you need to get going:

Computer—Software that actually turns your computer into a BBS is available for virtually all computers. You should have two disk drives: one to run the BBS and one to store files and messages. To get the board going, with lots of files and messages, you ideally should have a hard-disk drive.

Modem—An auto-answer modem that will answer incoming calls automatically is a must. A 1200-baud modem is highly recommended. Transferring files at 300 baud discourages long-distance callers.

Telephone—The family phone line will work OK, but then you'll have to train your BBS users to call only at special times. The best solution is to get a new phone line and phone number so your BBS doesn't have to share time with voice calls.

BBS Software—More than 60 commercial programs are available. Some cost hundreds of dollars, others are free. Here's a look at a few of the better BBS packages:

Ravics BBS, Computer Era, 206 Emerald, Anaheim, CA 92804; voice, (714) 778-4858; Commodore 64/128 ($100). A lot of Commodore sysops say *Ravics* is faster, easier to use, and more versatile than other BBS programs.

Fido, Tom Jennings, 2269 Market St. #118, San Francisco, CA 94114; modem, (415) 864-1418; IBM PC and compatibles, DEC Rainbow; ($100; free if downloaded). *Fido* is becoming the most popular BBS program, mainly because of its networking capability. Sysops using *Fido* can ship electronic messages to other Fido boards around the country.

Let's Talk, RUSS Systems, 320 Dufour, Santa Cruz, CA 95060; (408) 427-0310 for on-line demo; 128K Apple IIe/IIc, two disk drives ($175). The program is for programmers who want to set up and design their own system. It's a good choice for sysops who want to share text material (rather than programs) with their callers.

Mouse Exchange, Jacksonville, FL 32247; voice, (904) 396-6952; 512K Macintosh, two disk drives recommended ($40). One of the first BBS programs for the Macintosh, *Mouse Exchange* supports XMODEM transfers and has 10 security levels.

SYSOP TIPS

Sysops can run into some special problems once they open their computers to the public. Computer vandals may try to crash your board or destroy its data. For instance, a sysop in the Washington, D.C. area recently got help from the phone company to track down a teenager who transferred material from the BBS and demanded a ransom to return it.

Sysops have also encountered destructive programs, uploaded by unidentified callers. Colloquially known as "Arf, Arf" or "Trojan Horse" programs, they masquerade as harmless utilities, but when RUN, can erase all files on your disk drive. If you have a 10-megabyte hard-disk drive, this is a disaster. So beware of Greeks bearing gifts.

For this and other reasons, it pays to read everything that's posted on your BBS—you're responsible for it. When phone company investigators found stolen access numbers posted on a board in California, they got local police to arrest the sysop and confiscate his computer. The sysop argued that he didn't know about the postings and he eventually got his equipment back—but not without a lot of trouble and expense.

So welcome to the Network Nation. But, as Sgt. Esterhaus used to tell the "Hill Street Blues" crew, "Let's be careful out there!"

RIC MANNING *(CompuServe, 72715,210; The Source, STQ007) is editor of* Bulletin Board Systems, *a newsletter for BBS callers and operators, published eight times a year ($26.50) by Meckler Publishing Co., 11 Ferry Lane, Westport, CT 06880.*

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COMPUTING CLINIC

ACCOUNTING ON THE IBM PC*jr* • A $3,000 HOME-BUSINESS SYSTEM • MAGNETIC FIELDS • SMOKING AND COMPUTERS

BY JEFFREY BAIRSTOW

I plan to keep our farm records on an IBM PC*jr* computer. Can you recommend a modest bookkeeping program that uses double-entry accounting and includes a general ledger and journal format?
LEONARD L. THOMAS
Lodi, Wisconsin

One of several excellent, low-cost accounting programs for the IBM PC*jr* is *DAC-Easy Accounting*. The program is menu-driven and comprehensive. Included are general ledger, accounts receivable and payable, inventory, purchase orders, billing, and forecasting sections. The package is available at your local computer store or directly from DAC Software, Inc., 4801 Spring Valley Road, Bldg. 110-B, Dallas, TX 75244; (800) 992-7779; $69.95. *(See the "Let's Go to Work" feature in this issue.)*

I would like to buy a computer system to start a word-processing business, do my home finances, and access educational networks by modem, but I don't know where to begin. My budget for the entire system is between $3,000 and $5,000.
CINDY SWEENEY
Manteca, California

Your best bet is to begin with a few back issues of FAMILY COMPUTING, since these topics are covered often. For starters, check out the "Buyer's Guide to Business Computer Systems" (October 1985), "Buyer's Guide to IBM-Compatible Computers" (March 1986), "Word Processors" (November 1985), and the Working at Home (October 1985) and Home/Money Management (January 1986) departments.

Three computers that offer very good value for the money as home-business systems are the Tandy 1000, Leading Edge Model D, and Epson Equity. Whichever you choose, your final system should have at least 256K, two floppy-disk drives (or one floppy- and one hard-disk drive), and a high-resolution monitor (an entire system comes to around $1,500). To serve your clients, you'll also need a high-speed, wide-carriage daisywheel printer (about $1,000). For communications, you'll need a serial port and a 1200-baud modem (about $300). Then you'll need communications and word-processing software (about $200). These prices, of course, are ballpark figures, and will vary depending on the products. As given, the figures add up to $3,000.

Jeffrey Bairstow is a contributing editor for FAMILY COMPUTING.

Can smoke damage a computer or disks? My father smokes and our computer is in his office. I put a towel over the disk drives to prevent smoke entering them. Does this do any good?
DOUGLAS BARTELS
Chicago Heights, Illinois

Unless the quantity of smoke your father produces prevents you from seeing the monitor, I doubt that it will damage either the computer or the disk drives. However, ash from cigarettes, cigars, or pipes is another matter. Ash can damage floppy disks and harm the drives; it can get into keyboards and cause faults; and it can wreak havoc inside a printer. Quite frankly, smoking, eating, and drinking are not computer-compatible activities and should be pursued separately for the computer's health.

I often place my floppy disks near my monitor, but I've heard that a magnetic field inside it can erase disks. Is this true?
MICHAEL PRESTON
Holden, Massachusetts

It is true that monitors (and other devices, including printers, computers, vacuum cleaners, and file cabinets) produce magnetic fields, but these are usually too weak to harm disks. However, people have had disks erased by magnetic fields, so I wouldn't take a chance. Don't place disks on top of a computer, monitor, printer, disk drive, or anywhere else where there might be a possibility of damage, either by the magnetic field or by heat. Store disks well away from your computer system as a precaution. Better safe than sorry.

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The Funhouse Caper is a totally involving TWISTAPLOT™ adventure in which your child solves three spine-tingling mysteries by questioning suspects and sleuthing for clues. The program *sharpens reading comprehension and map skills.*

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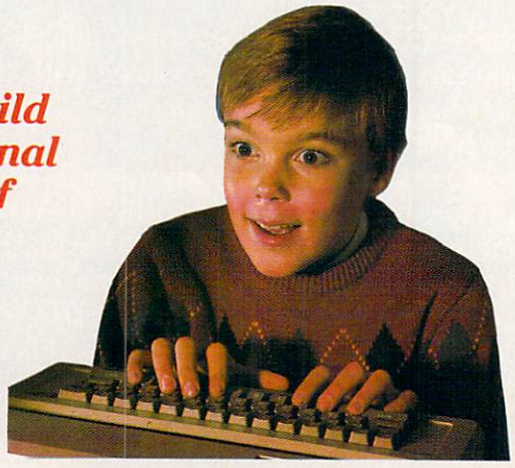

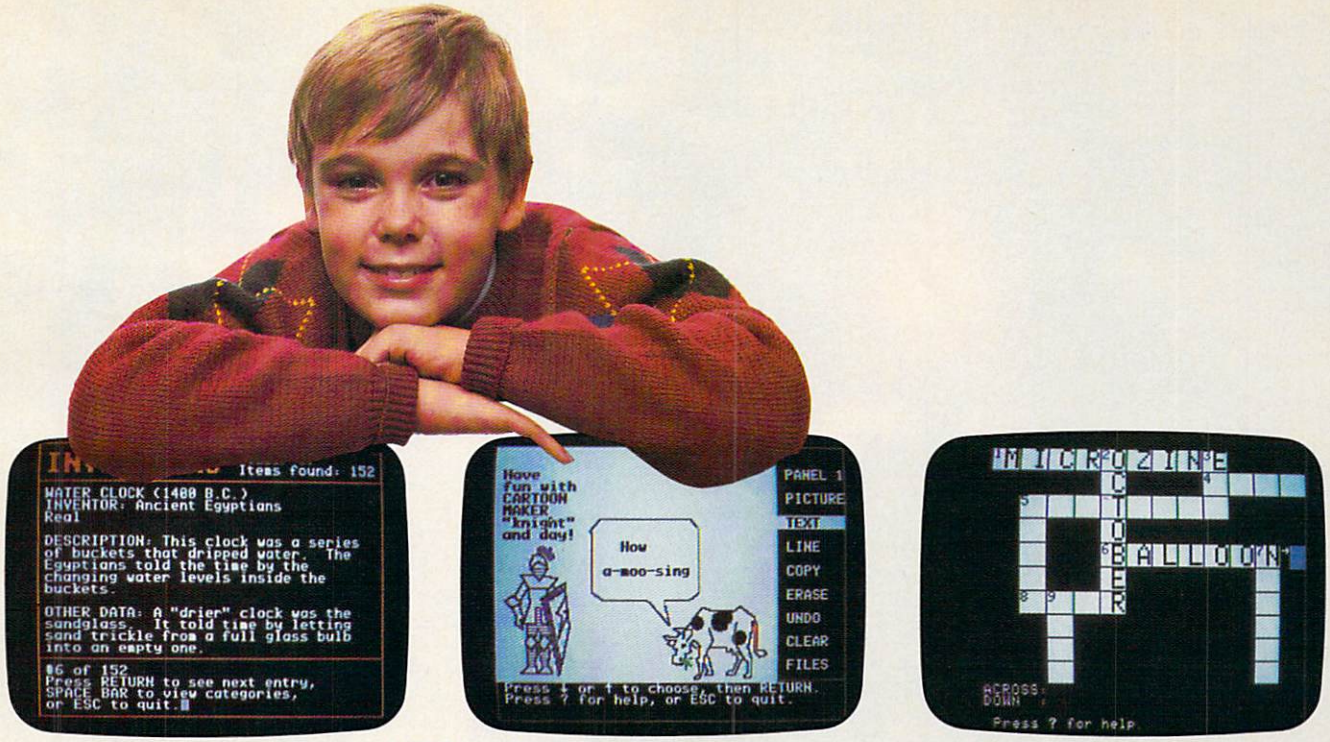

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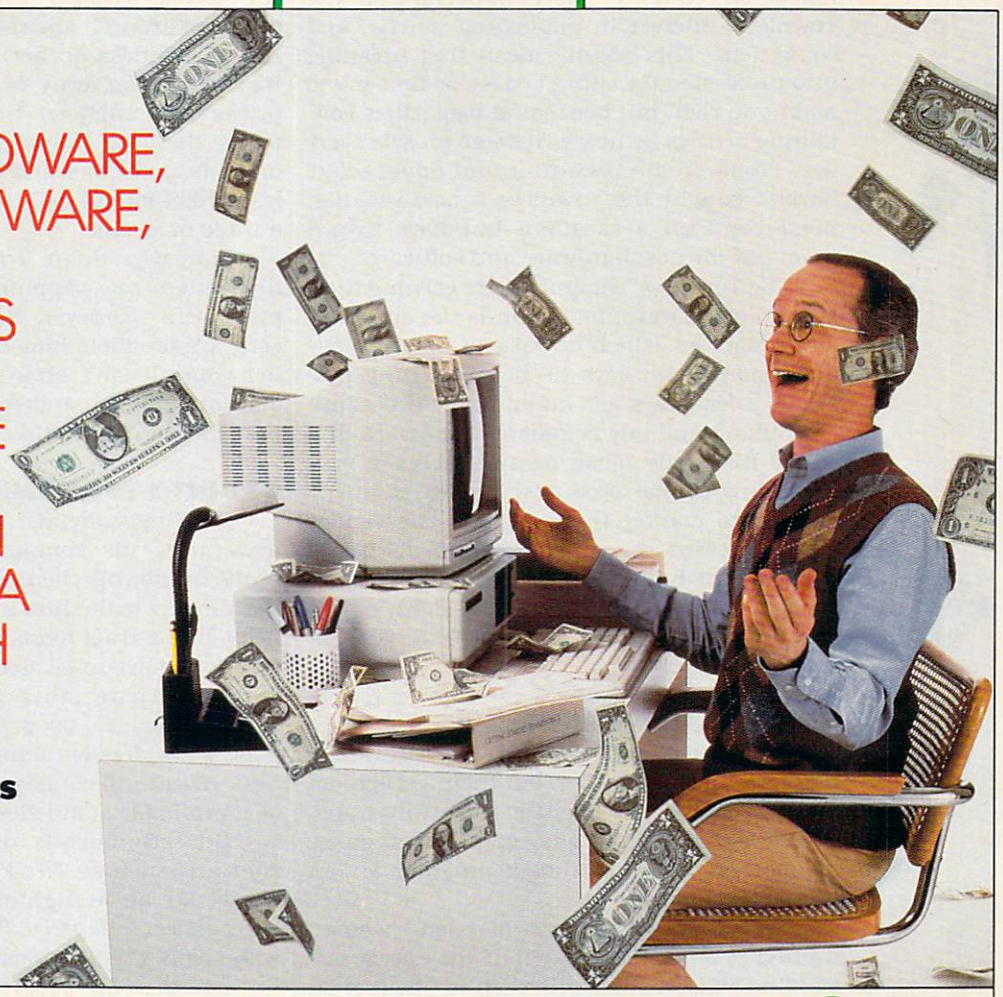


BY TAN A. SUMMERS

Make Money With Your Computer

You may be wondering how to justify the cost of a new computer. Or maybe you're searching for ways to make some extra pocket money. You don't have to look any further than your computer. Making money with your computer is simply a matter of combining your interests, abilities, and imagination with your computing know-how. Plenty of people are putting their computers to work, and it's about time you got in on some entrepreneurial action. Here's how it's being done, and how you can do it, too:

BE A PUBLISHER

John and Christine Townley of White Stone, Virginia, use their Apple Macintosh to edit and publish a quarterly newsletter, *Concertina and Squeezebox*. The newsletter grew out of the Townleys' interest in sharing their knowledge of historic seafaring music and instruments with other enthusiasts.

The Townleys make the publishing business sound easy. They use the Macintosh, *MacWrite* word-processing software, and an Apple ImageWriter dot-matrix printer to produce text that they lay out by hand and then drop off at a nearby copy shop. John points out that software, such as *PageMaker* (Aldus Corp.), *Fontrix* (Data Transforms), and *Fontasy* (Prosoft), lets you lay out a newsletter or newspaper right on the computer. Then you can make all the copies you want, right from your printer. It's like having a printing press in your home!

How did they market *Concertina and Squeezebox*? "We bought a mailing list from a music dealer, then expanded our readership by word of mouth and with ads," says John. The Townleys lowered postage costs by designing the publication as a newsletter, rather

PHOTOGRAPH BY JOEL WHITE

TAN A. SUMMERS, *author of* Small Business Guide to PC Compatibles, *wrote "How to Make Your Move Go Smoothly—With a Computer" in the June 1985 issue.*

than as a heavier magazine.

John has magazine experience, but that's not a prerequisite. More important is the Townleys' interest in publishing, music, and computers. This doesn't mean that breaking into professional writing is easy or that it will make you rich, but books and magazines containing articles by new writers go on sale every day. Profits from *Concertina and Squeezebox* haven't bought the Townleys a new vacation home—or even a vacation—but have helped them pay for new hardware and software.

The Townleys' computers are earning their keep in other ways, too. John is the author of four programs, which he uses for his astrology profession. John says he began writing programs a few years ago on an Apple II because he couldn't find any commercial software that suited his needs. Then he approached a vendor selling similar products, and the company decided to market the program. The vendor also suggested the other program John has written, which he hopes to license to a maker of arcade machines. Together, John's programs bring in close to $5,000 a year in royalty checks.

EXPLORE NEW LANDS

Indeed, making money writing software is harder than it used to be, but there's still room for newcomers. You might start out by translating programs from one computer language to another, or by writing a program for an overlooked application.

Several years ago, one Maryland woman wanted to do something about the energy crisis. She and her husband, with the help of an engineer friend, wrote a computer program to determine the correct-size heating and cooling units that should be installed in buildings under construction. At first, the woman offered the service to local contractors free, but as word got around, she realized she had a flourishing business on her hands. Now, contractors from as far away as Florida send her blueprints to be analyzed. She charges by the job, using the cost of having a secretary do the analysis as the basis for billing. She advertises by word of mouth and through monthly ads in a trade magazine.

Similarly, John Townley advertises his newsletters by swapping ad space with other publishers. However, he doesn't market his software products himself. "Marketing a product yourself isn't always a good idea," John advises. "You get so involved in the marketing that you don't have time to write anymore."

GET INTO THE NUMBERS GAME

Gil Guggenheimer, an insurance salesman, uses his computer to do income-tax forms free for his clients. His tax business may not directly make him money, but it certainly helps him attract more insurance clients. (No, you *don't* have to be a certified public accountant to prepare other people's tax returns.) Guggenheimer's tax-preparation service enhances his already-established insurance business venture that's based at home, but it can be a profitable stand-alone enterprise as well.

Gil recommends using commercial tax software, such as *Tax Preparer* (HowardSoft). "It would be a nightmare to do it with a spreadsheet," he says. "With commercial software, all of the formulas are built in."

Commercial programs (*see the Home/Money Management department in February for a listing of tax-preparation software*) include tax-law information and detailed instructions for preparing tax forms and schedules. Annual classes with the Internal Revenue Service to keep abreast of new tax laws aren't a bad idea, either. Paid tax preparers must sign the forms, so be sure to verify the financial information clients give you.

Two more services that are always in demand are bookkeeping and accounting. There are lots of small businesses that don't need—and can't afford— in-house bookkeepers or outside accounting firms. Do you know anything about accounting or bookkeeping? You can offer to keep a business's books, using your computer. It may be as easy as picking up receipts a couple of days a week, recording them on a spreadsheet, and providing reports as needed.

If possible, add extra services so you can get more money. Here's one idea: Maintain a company's mailing list and conduct mailings as well. You can subcontract the affixing of mailing labels—hire neighborhood teens or responsible family members to do the work after school under your supervision. The U.S. Postal Service provides instructions on how to prepare the pieces for mailing. Decide what to

CHOOSING THE RIGHT EQUIPMENT

Before you plunge into your new business scheme, make sure you have all of the proper computer hardware and software.

Data Management and Financial Services

BUSINESSES: bookkeeping; accounting; inventory; tax preparation; mailings

COMPUTER: 256K or more (512K for Macintosh)

PRINTER: fast dot-matrix

SOFTWARE: dedicated software in the appropriate category (i.e., tax preparer, spreadsheet, data base)

Desktop Publishing

BUSINESSES: newsletters; newspapers; advertising

COMPUTER: graphics capability for displaying enhanced fonts; adequate memory for selected software

PRINTER: letter-quality or near-letter-quality

DIGITIZER (optional): compatible with computer; for including photos and other noncomputer art

SOFTWARE: typesetting software capable of formatting text in different font sizes and styles

Word Processing

BUSINESSES: typing; résumé preparation

COMPUTER: professional-quality keyboard; high-resolution monitor; 80-column display capability; sufficient memory for selected software

PRINTER: letter-quality

SOFTWARE: word processing, capable of sophisticated editing and large file size

Information Gathering

BUSINESSES: research; market research

COMPUTER: any computer equipped with serial port

MODEM: 1200 baud

SOFTWARE: communications software that allows data capture

Miscellaneous

BUSINESSES: tutoring; programming; general record-keeping

Your favorite computer, software, and printer will do just fine!—T.S.

charge by pricing the same kinds of jobs at firms in your area.

BUILD A WORD-PROCESSING OR RESEARCH SERVICE

If financial services aren't up your alley, try word processing. In our October 1985 issue, Barbara Stein wrote about how she started a successful word-processing business from her home. Armed with $2,600 worth of equipment, a computer, a word-processing program, a spelling checker, and a letter-quality printer, Stein set up a part-time business that rakes in about $300 a week. A related idea might be a résumé service. In addition to typing the résumé and providing professional-looking copies, you could use the word processor to tailor a different version of the basic résumé for each prospective employer.

If you go the word-processing and résumé-service route, hunt down customers at local colleges. Where else will you find such an enormous concentration of people who need reports and résumés typed? To ensure that customers come knockin' down your door, underbid all the local print shops.

Another business idea that can be marketed to college students is a research service. With a modem and a powerful subscription data base, you can gather information that a student may need, and base your rates on the actual costs you'll incur, plus fees for your services. Also, you may find businesses that need research done, for example, on their competition. If the data base provides only abstracts and bibliographic information, you can charge extra for a trip to the local library.

BRANCH OUT

Does the thought of a risky new business adventure make you uncomfortable? Try using your computer to assist an already-established business. Take advantage of productivity software intended for more traditional business situations, or come up with new ideas of your own, as did Diana Gardner, who operates a licensed day-care center from her home in Odenton, Maryland. Her business didn't boom until she added computer instruction for the two- to six-year-olds in her care. Gardner estimates that her day-care business garners between $1,000 and $1,300 a month. "A lot of people want their children to have an educational experience rather than just day care," Diana explains. "One woman brought her child for three hours a day just for the computer experience."

If you decide to add computer instruction to a day-care center or babysitting service, Gardner suggests choosing simple learning programs, such as Logo software, and fun programs that develop reading and math skills. "You don't have to be a computer expert," Diana says. "Just stay ahead of the children you're teaching!"

Anyone in the family who earns money can make the endeavor more productive by using the computer—and that includes kids. If someone in your house mows lawns, delivers papers, or walks dogs, he or she can use the computer to keep records, create flyers, or improve productivity—even to the point of managing others doing the same work.

1-2-3—BEFORE YOU GO!

The time you'll need to put into your business and how much money you can expect to earn depends on you and the task at hand. (*See "Making Your Business a Success," below.*) That, in turn, will determine how much you can afford to spend on new computer equipment, software, and office furniture. Keep these suggestions in mind:

1. Be realistic in your expectations. Many home-based businesses are sidelines that bring in regular pocket money and an occasional modest windfall, rather than a sizable, fixed income. For example, the Townleys' *Concertina and Squeezebox* hasn't made much of a profit, but it has covered the cost of a new computer system. Most computer buffs would consider that alone a valuable contribution to the family budget.

2. Pick a field you know. With some jobs you can learn as you go, but your chances of success are greater if you've had some previous experience. For example, Diana Gardner, while not a computer expert, has a degree in early childhood education.

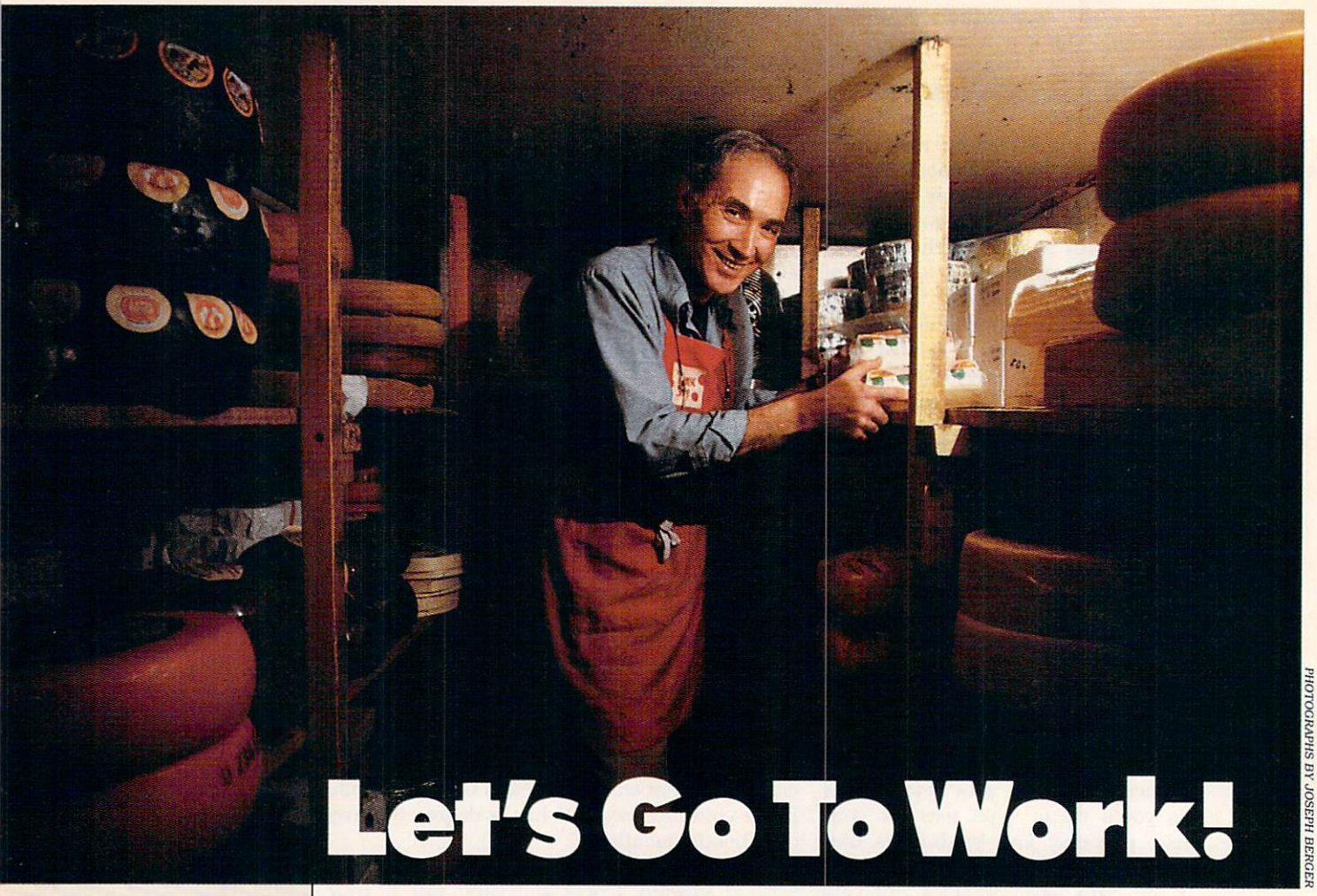
3. Plan to invest plenty of time to get your venture started. Costs will vary, but if your plans are ambitious, you might need to borrow some cash to get started.

Despite all this, succeeding in your own computer-related business is exciting. Even the thrill of getting your first paycheck may be overshadowed by the realization that now you're really part of the computer revolution. Suddenly, you're no longer just a bystander, but a full-fledged participant. FC

MAKING YOUR BUSINESS A SUCCESS

1. Choose work on the basis of your skills, or take a few classes to acquaint you with a new field.
2. Before you plunge in, factor in the amount of money and effort you're willing to spend. Make sure you have plenty of time for your business venture.
3. Be aware of laws governing the work you've chosen: zoning, tax, licensing, and bonding.

   Set aside a specific place to work. If other family members will use the computer too, set up rules for computer use and keep your materials safely out of reach.
5. Plan to eliminate interruptions—a telephone answering machine can be a big plus.
6. If you deal directly with customers, set realistic business hours and stick to them.
7. Set reasonable rates for payment. Do some research on how much others in your area are charging for the same services.
8. Seek out local small businesses for customers. The businesses themselves may need your help, or they may direct you to potential customers. Look at college bulletin boards and the classifieds, too.
9. Keep accurate records of all aspects of your business: expenses, income, time spent working at the computer, and client or customer names and addresses.
10. Remember: Much of the money you put into a home business is tax deductible. Keep all receipts and consider consulting an accountant. The amount of money you get back from the federal government may mean the difference between a financial failure or a money-making venture.—T.S.



PHOTOGRAPHS BY JOSEPH BERGER

Let's Go To Work!

INTRODUCING BETTER SOLUTIONS FOR YOUR BUSINESS TASKS

BY DAVID HALLERMAN AND ROBIN RASKIN

Joseph LaMarca tallies his inventory.

There's something odd about the LaMarca Cheese Shop in Manhattan's Gramercy Park neighborhood: no cash register! Instead, the customers' money goes into a gray metal cash box. It seems unusual for an upscale fancy food store to handle its transactions in such an old-time, mom-and-pop-shop fashion.

Behind the low-tech facade, however, stands a high-tech solution. Owner Joseph LaMarca explained, "By keeping track of how much cheese I've sold, its sale prices, my margins, and how many products I have on hand, my computer tells me how much cash there should be, down to the closest dollar."

STARTING TO COMPUTERIZE A BUSINESS

Aside from dozens of types of cheeses, LaMarca sells such gourmet staples as pâtés, fresh breads, whole coffee beans, quiche, and pasta salads. When LaMarca, a 51-year-old marathon runner, opened the shop late in 1974, tracking his goods was a pencil-and-paper affair. Less than three years later, in the earliest days of microcomputing, he purchased Tandy's TRS-80 Model I with a whopping 4K memory. As he put it, "Disk drives didn't exist then for personal computers, so I had to save everything on a cassette tape. And there was no data-base software around that would let me track hundreds of items and compare categories of information, so I made up my own."

The data base he "made up"—and ported over to his Kaypro 10 computer a few years later—now allows him to do what any good, commercial, off-the-shelf data base can. After a weekly "eyeball" inventory, LaMarca inputs into his computer what's in the store and what's in storage in the basement, adding information about new purchases. Every Sunday, the program generates printed reports that show his total inventory by value, quanti-

Before he became FAMILY COMPUTING*'s reviews editor,* DAVID HALLERMAN *labored seven years in sales and marketing.* ROBIN RASKIN *is a contributing editor for the magazine.*

ty, price, and markup percentage weighted by sales volume.

Having a handle on his markup is why, when he gets on the phone with cheese wholesalers or visits them in person, he can make the best deals possible. LaMarca always knows exactly what any cheese has cost him in the past, how much he has in stock, and how old it is. Many cheeses get better as they age, so buying cheaply now to sell a better product at a higher price later makes sense for his business. But trying to control all this information without his data base would add hours to LaMarca's already busy day. As it is, he needs less than 10 minutes each day to type in the daily sales information (and an extra five minutes on Sundays to print out the reports).

MEANWHILE, ON THE OTHER COAST...

In Pleasant Hill, Oregon, a few miles southeast of the university town of Eugene, Jim Bryson lives and works. An independent sales representative, Bryson travels throughout Oregon, Washington, and California, peddling yarn to knitting stores. Let's stress the word "independent" here, since he has no one to help with his voluminous paperwork except Robin Habeck, a part-time assistant paid from his own pocket.

Unlike Joseph LaMarca, Bryson was in business for years before computerizing. About a year ago, he bought an Apple IIe and the *AppleWorks* integrated program. In his typical, understated style, Bryson commented, "It would be difficult to go back to working without a computer."

A sales rep's work is not confined to visiting accounts. Since he carries six lines of mostly imported yarn (or "string," as he colloquially calls it), Bryson has six companies about which he sends out promotional mailings to more than 600 stores.

"I use a mailmerge program with the *AppleWorks* word processor to create personalized form letters about particular products," he said. "I get to see each account only two or three times a year—which isn't often enough—so the more they hear from me, the more they think about my company." And the more they buy from him.

On the same disk with the word processor, *AppleWorks* contains a data base and a spreadsheet. The data base is a big help for maintaining a customer list. With it, Bryson can print out mailing labels in zip code order, which saves money on the bulk-mail rate. Besides filing every account's address and phone number, he also tracks each visit and phone call. Afterward, he marks down what's selling, what items they're looking for, and the general trend of their businesses. The data base also tickles his memory about customers' birthdays. "People remember getting cards for their birthdays more than they do Christmas cards," he said. "That's what most of my competitors send."

Bryson maintains his leading edge with the *AppleWorks* spreadsheet, using it to keep a log of his expenses (such as automobile use, lodging and meals on the road, and mail and phone costs). At any point, the spreadsheet can tell him how much he has spent so far for the month or the year. "It makes my accountant and the IRS happy," Bryson said. The spreadsheet also helps him avoid wasting money, since he can see at a glance if his expenses are too high.

"Before I got my computer," Bryson said, "my sales volume would increase anywhere from 10 to 15 percent each year. Since then, my sales have increased over 25 percent." Here's one user who doesn't doubt that his computer is paying for itself. "It's a real boon," he added. "It allows me freedom, because [with it] I can reach a lot of people in a short amount of time."

BETTER WORKING THROUGH SOFTWARE

For both Jim Bryson and Joseph LaMarca, computer software has meant greater work productivity. What does this mean for you? Well, computing is flexible. People in vastly

A BROADER PERSPECTIVE ON BUSINESS

There are certain categories of business software (and some of their uses) that are beyond the more general scope of this article. Page-layout programs for "desktop publishing" can be important in businesses that are graphically intensive. Other graphics programs are useful for business presentations, creating pie charts, graphs, and other visuals. Planning, an important factor in creating an effective presentation, can be helped by outline programs (aka "idea processors") such as *ThinkTank*. When you're running a major project (as contractors do), programs known as "project managers" can help you keep a handle on time, labor, and materials. If your work includes research, a communications utility will help you get online information.

Yet another kind of specialized software addresses what are called "vertical markets." Depending on your work, you've probably heard of such packages, designed with specific professions in mind. There are programs just for stockbrokers, farmers, real estate agents, bookstores, and so on. Even within professions, further specialization can occur; programs exist for tax lawyers only, and there's software solely for personal-injury firms. The best places to find out about vertical-market software are in trade magazines or through professional associations.

PHOTOGRAPH BY ROBIN HABECK

Jim Bryson with some fine wool.

EDITORS' CHOICES: SELECTED SOFTWARE FOR BUSINESS

When it comes to running a business by computer, there are many levels of software. You can try to stretch a package designed for home use beyond its normal power (not the best solution) or you could buy those packages used by major corporations (which may be overkill). That's why we've put together this list of mostly mid-range business software: programs that work best for managing small businesses.

KEY: GL/General Ledger; AR/Accounts Receivable; AP/Accounts Payable; PAY/Payroll; INV/Inventory.

ACCOUNTING

Back to Basics Accounting System ($195–$395/complete system; $60–$95/separate modules)
Peachtree Software
(800) 554-8900
Apple, Atari, C 64/128, IBM PC/PCjr, Macintosh.

Designed for beginners as well as professionals. Integrates GL, AR, and AP into one package (modules also available in separate packages). Creates complete reports.

BusinessWorks ($95/System Manager; $395–$445/other modules)
Manzanita Software
(916) 781-3880
128K Apple IIe/IIc with two 3.5-inch UniDisk drives, or one UniDisk drive and hard-disk drive.

Emulates *AppleWorks* in on-screen structure, and shares files with it. Along with the System Manager, buy the GL, AR, AP, PAY, and INV modules in separate packages as needed.

DAC-Easy Accounting ($70)
DAC Software, Inc.
(214) 458-0038
IBM PC/PCjr.

Incredibly low in price, but not in quality. Com-

plete, menu-driven, integrated package, with GL, AR, AP, and INV.

Time Is Money ($99–$125)
Turning Point Software
(617) 923-4441
Apple, IBM PC/PCjr.

Personal-finance package powerful enough for individual and small business use, since it accepts as many as 240 accounts, income sources, and types of expenses.

DATA BASE

DB Master ($195–$350)
Stoneware, Inc.
(415) 454-6500
Apple, Atari 520ST, Macintosh.

A relatively easy to use, though complex, relational data base. Best for businesses with many data-base needs like large mailing lists or inventories.

Friday! ($295)
Ashton-Tate
(213) 329-8000
IBM PC.

Simplified, menu-driven version of *dBase II*, with which it can exchange files. When combined with a word processor, form letters may be merged with mailing labels printed by *Friday!*

H & D Base ($100)
Mirage Concepts
(209) 227-8369
Atari 520ST.

Relational data base allows report function to stretch across multiple files. Actually, a complete data-base language, just like *dBase II*.

Superbase Starter ($50)
Precision Software, distributed by Progressive Peripherals & Software
(303) 825-4144
C 64/128.

Stores more information than many other data bases for the C 64. Helpful for invoices or inventories, since it allows arithmetic calculations to be performed on your data.

DESK ACCESSORIES

BatteryPack ($50)
Batteries Included
(416) 881-9941
Macintosh (512K recommended).

Installs desk accessories to the "Apple" menu, such as a calendar, two types of calculators, and other utilities to make work easier.

MaxiDesk ($70)
MaxiSoft, distributed by Electronic Arts
(415) 571-7171
Amiga.

Make appointments, keep notes, track addresses, print labels, and more, including the nice surprise of having the clock or calendar talk.

Partner ($50–$60)
Timeworks, Inc.
(312) 948-9200

different professions can use the same software for both common and divergent tasks. For instance, a data base is an excellent tool for maintaining a mailing list, a task common to both pediatricians and plumbers. But while the doctor might also use the data base for keeping an appointment calendar, the same program could be used by the plumber to track his parts inventory.

As you can see in the "task" charts accompanying this article, you can use more than one category of software for a given purpose. Which type to choose depends on several factors, including how intensively you perform any task, what software you already own, and how adept you are with a particular type of software.

For example, if you find that wielding a spreadsheet comes easily (and it does for many people, even those new to computing), you could set up one to handle your bookkeeping. But if creating spreadsheet formulas is difficult for you, then a software package dedicated to accounting or personal finance would probably be a better solution.

Continuing with the same example, if the spreadsheet user's business grows beyond a certain point, then employing that type of program for bookkeeping could be cumbersome. Then, turning to a dedicated accounting package would be a better bet (no matter how comfortable you are with a spreadsheet), even though it will take time converting from one to the other.

Then again, choosing the best software for your business tasks is not simply an either-or question. Should you have a large mailing list to maintain, for instance, a program designed for that purpose could easily solve your problems. However, if you already own a data base with enough capacity, you could set up that program for your list, as Jim Bryson did. In this case, the data base's advantage over the dedicated package is its flexibility for more information; its main disadvantage lies in its (generally) greater difficulty in initial setup.

PROGRAMS TO BOOST YOUR BOTTOM LINE

In this article, we'll examine the software needed by people who manage a wide range of small businesses, particularly ones just beginning to computerize.

As general-purpose tools suited to a variety of tasks, word processors, spreadsheets, and data bases are fundamental. In simplest terms, word processors are for writing, spreadsheets are for manipulating numbers, and

ALTERNATIVES FOR SOLVING BUSINESS TASKS: Mailing Lists and Writing

TASK: Keeping a list of clients, customers, or patients. Printing mailing labels.

SOLUTION	HOW IT WORKS	FEATURES TO LOOK FOR
Word processor	Enter each name, address, and phone number on simple list, then use search function to find specific info. No sorting capability.	Most word processors would suffice, but look for "macros," which condense multiple keystrokes to one or two strokes.
Data base	Set up your own categories that allow more than just name, phone number, etc Use sort function to arrange, report to extract specifics (i.e., all your clients with birthdays in June).	Chronological, as well as alphabetical, sort function. Report capability very important. The hardest to set up, but potentially the most flexible, powerful.
Mailmerge software	Gives you predesigned templates that include space for name, address, phone, birthday, etc. Actually a simple data base in disguise.	Ability to add categories to suit your individual needs. Custom report formats and printer control are helpful.
Desk accessory software	Often a simple, "Rolodex"-style file for names, addresses, and phone numbers. Usually less flexible for additional info than a data base.	Make sure there's enough room for all the names on your list; a desk accessory file cannot be as complete as data base.

TASK: Sending out personalized mass mailings.

SOLUTION	HOW IT WORKS	FEATURES TO LOOK FOR
Word processor	Insert codes (such as "<1>" for name) in form letter, then set up mailing list. When program is run, specific names will substitute for codes.	More sophisticated word processors have mailmerge built in, or can use separate data base to set up mailing list.
Mailmerge software	Combines simple word processor for short documents with file for names, addresses, and some more data. Usually easier than word processor.	Ability to use files from other programs or to create compatible files. Enough capacity for your mailing lists.

TASK: Writing the same phrases, paragraphs, or letters repeatedly and regularly.

SOLUTION	HOW IT WORKS	FEATURES TO LOOK FOR
Word processor	Insert the repetitious text automatically while printing, or at a keystroke while writing by using macros. Or make your standard text into separate files, and load as needed.	Again, macros. Wherever found, they're your main tool for customizing productivity software to your way of working.

data bases combine qualities of the two, arranging information comprised of both words and numbers. Sometimes these tools are used as stand-alone programs; other times you'll find them as part of an integrated package.

For many businesses, accounting software can be just as basic. And then there are two common business tasks—personalizing form letters and tracking appointments—with two specialized software solutions: mailmerge programs and desktop accessories. (*See "A Broader Perspective on Business" for further listings of business software.*)

THE POWER FEATURES OF BUSINESS SOFTWARE

Word processor. Beyond its use for writing itself (letters, reports, etc.), a business-class word processor should have a "macro" feature, sometimes called a "glossary." With this function, you make one or two keystrokes represent a large number of keystrokes (i.e., a paragraph or a complicated set of commands). Then, by pressing the key(s) you've coded for your macro, the program will automatically insert all the words, or perform all the commands, assigned to it. For example, you could set up the letter "C" on a macro to insert a standard closing of a letter. Not only does this make it easy to insert pieces of standard text (often called "boilerplate") into your documents, it also allows you to automate many of the word processor's other functions (such as mailmerge or cataloging disks), a big time- and memory-saver. Mailmerge capabilities are usually built into sophisticated business word processors.

Data base. One key feature to look for in a data-base manager is the ability to sort by date as well as by alphabetical order. The data-base manager should have a complete, built-in report function, which allows you to extract only the information you need from a mass of data. And "complete" means here the ability to perform arithmetic calculations on your numeric data, such as totals or averages. That's useful in tracking inventories, printing invoices, and more.

Spreadsheet. Spreadsheet software can be the single most versatile tool for many businesses. It will take you from making appointments to bookkeeping, and from tracking small inventories to financial projections. The ability to link various spreadsheets to exchange data makes accounting, for one, easier, since the "books" can then be constructed in modular form.

Accounting systems. While spreadsheets can help business people with their financial records, accounting packages become necessities as businesses grow. The best packages come in modules that work as stand-alone programs and integrate the information as needed. Modules are usually purchased separately. The most common accounting modules are general ledger, accounts receivable, accounts payable, payroll, and inventory.

For some bookkeeping, a general ledger program with a double-entry journal is all the power needed for managing the show. Then, as your business expands, you can add the other modules. A general ledger acts as a kind of central clearing house for the other modules, creating reports such as income statements and balance sheets. In basic terms, accounts receivable programs track who owes money to you and accounts payable programs track the people you owe. Payroll modules are easier than spreadsheets employed for the same function, because they can serve as an

ALTERNATIVES FOR SOLVING BUSINESS TASKS: Appointments and Basic Bookkeeping

TASK: Scheduling appointments.

SOLUTION	HOW IT WORKS	FEATURES TO LOOK FOR
Data base	Set up each record as a day of the week; each field represents an appointment time. Might not be easy to see a month at a glance, though.	Almost any good data base should work. Capability of multi-record on-screen display would be helpful for overview.
Spreadsheet	Good for businesses based on appointments with different people, like haircutters. Rows could be times of day, and columns different people.	The capability of manipulating numbers in a time format and unlimited column widths for names would be helpful.
Desk accessory software	Most offer what looks like a paper calendar; you just fill in the information. Might be the easiest of the three, certainly most convenient.	Seems to be a standard feature in all the desk accessories we've seen. File transfer to word processor is helpful.

TASK: Basic bookkeeping/accounting.

SOLUTION	HOW IT WORKS	FEATURES TO LOOK FOR
Spreadsheet	Can emulate a general ledger, with one spreadsheet for income, another for expenses. Then, link the two for double-entry bookkeeping.	Sorting capabilities and full control of print-outs. Ability to link different spreadsheets gives you room to grow.
Personal finance software	Designed to record income and expenses, then assign each transaction to an account. Useful for balance sheets or small-business budgeting.	Ability to track numerous accounts and a full report module. Best when your business and home life are intermingled.

C 64, C 128 (separate versions for each).

Offers Commodore users a "pop-up" calendar, calculator, phone dialer, and more. Since it's a cartridge, doesn't take up any memory. (Prerelease version reviewed.)

Pinpoint ($69)
Pinpoint Publishing
(415) 654-3050
Enhanced 128K Apple IIe/IIc.

Adds desk accessories to *AppleWorks*, such as appointment calendar, note pad, and automatic phone dialer. Greater memory than 128K makes it more convenient.

SideKick ($85)
Borland International
(408) 438-8400
IBM PC/PC*jr*, Macintosh.

The granddaddy of desk accessories is a memory-resident appointment calendar, notepad, phone dialer, calculator, and more. A standard of sorts.

INTEGRATED

AppleWorks ($250)
Apple Computer
(408) 996-1010
Apple IIe/IIc (128K recommended).

A word processor, data base, and spreadsheet on one disk (data base strongest of three). With many add-on programs available, can be powered up for business use.

Electric Desk ($345)
Alpha Software Corp.
(617) 229-2924
256K IBM PC/PC*jr*.

Easily switch back and forth between word processor, spreadsheet, data base, and communications utility. With macros and on-line help screens.

Jazz ($595)
Lotus Development Corp.
(617) 494-1192
512K Macintosh.

Pulls together word processor, spreadsheet, presentation graphics, data base, and communications. But has no macro capability.

MAILMERGE

Bank Street Mailer ($50–$70)
Broderbund Software
(415) 479-1170
64K Apple, 128K Apple IIe/IIc, C 64/128.

Don't be fooled by the Bank Street name; for sending personalized mass mailings, this program has enough power for both small-business projects and home use.

Express Letter Processor ($50)
Mirage Concepts
(209) 227-8369
Atari 520ST, IBM PC/PC*jr*, Macintosh.

Combines a word processor with a data base; both are simple, letting

you write letters and then merge the text with information from the data-base mailing list.

SPREADSHEETS

Multiplan ($95–$195)
Microsoft Corp.
(206) 828-8089
Apple, C 64/128, IBM PC/PC*jr*, Macintosh; (C 64/128 version published by Epyx: 408-745-0700).

A complete spreadsheet that can take you from novice level to advanced. Sort function makes it good for record keeping. Since it's long established, there are templates available for things like bookkeeping or inventories.

SuperCalc 3 ($395) and **SuperCalc 3a** ($195)
Computer Associates
(408) 942-1727
Enhanced 128K Apple IIe/IIc (3a), IBM PC.

Integrates powerful spreadsheet that doubles as a row-and-column data base with graphing capabilities: bar graphs, pie charts, etc.

WORD PROCESSORS

Apple Writer II ($149)
Apple Computer
(408) 996-1010
Apple IIe/IIc.

Fast, command-driven, and particularly good for mailmerge and repetitious writing, since it has macros and is also programmable.

Microsoft Word
($195–$395)
Microsoft Corp.
(206) 828-8089
IBM PC/PC*jr*, Macintosh.

Complete macro functions allow easy creation of boilerplate and mailing labels. Works with *Microsoft File* (Mac) for mailmerge, or will create merged documents alone.

PaperClip ($60–$90)
Batteries Included
(416) 881-9941
Apple, Atari, C 64/128.

Serious, high-quality word processor includes form letter, mailing list, and label-printing functions. Contains programmable macros.

WordPerfect ($180–$295)
Satellite Software International
(801) 227-4370
128K Apple IIe/IIc, IBM PC/PC*jr*.

With all the features many business users will ever need, this high-end word processor includes macros, mailmerge, various fonts, and the ability to print mailing labels.

Unless otherwise noted, minimum memory requirements are 48K for Apple, 48K for Atari 800/XL/XE series, 128K for IBM PC/PC*jr*, and 128K for Macintosh.

employee data base and automatically account for the various paycheck deductions. Inventory modules not only track goods or supplies, they also give you different accounting methods for valuing them.

Mailmerge software. Certain programs created solely for mailmerge combine a word processor of sorts with a name-address-phone file. Whether you use one of these dedicated packages or a word processor, here's how mailmerge works: Say you sell children's clothing, and you want to send letters about a sale to your customers. You could arrange your list of names and addresses with a code for each child, indicating girl or boy. Then, in the body of the form letter, there would be a statement meaning, "If the code is 'B', then put the word 'boy' in the text, or else put the word 'girl'." Such if-then-else statements are a form of programmability.

Desk accessories. "Desk accessories" or "desktop organizers" are one of the hottest categories of software. Desk accessories offer tools like appointment calendars, calculators, note pads, name and address files, and phone dialers. Within this context, "desk" implies that the program is available at a keystroke, even as you run other programs. The accessory appears and your main program goes away temporarily. Then, at a second keystroke, the accessory goes away and the main program returns.

Depending on which computer is used and how it's configured, desk accessories are always ready to "pop up" because 1. they are installed in a part of memory not used by your main program, aka "memory resident accessories"; or 2. they come on cartridges, which, in essence, add extra memory to your computer; or 3. they remain on disk, but the disk must remain in one of your disk drives; or 4. they work on a computer that is designed to run more than one program at a time (the Amiga is the prime example here).

DISCOVERING THE RIGHT SOLUTION FOR YOU

When you're just beginning to add a computer to your business, emotions may swing from "these machines will do everything for me" to "there's nothing out there that will do exactly what I want." Consider how Joseph LaMarca and Jim Bryson use software in their businesses, however. Notice that they've succeeded by breaking down their work into different tasks—and not by trying to have the computer do everything.

For example, LaMarca does not use a word processor or mailmerge to send letters or flyers to his customers; someday, maybe, but not now. And Bryson does not use the computer to track shipments of yarn and commissions due, although he might eventually. After you've analyzed your work tasks with the help of these charts, you'll have a better idea of how software—and *which* software—can help you save time and make money. Now isn't that what it's all about? FC

ALTERNATIVES FOR SOLVING BUSINESS TASKS: Accounting, Payroll, and Inventory

TASK: Managing a business with several employees or an appreciable inventory.

SOLUTION	HOW IT WORKS	FEATURES TO LOOK FOR
Accounting system software	Mimics manual accounting: you enter debits and credits in journal (includes AP, AR), then entries are posted to general ledger by accounts.	All offer GL, AP, AR; some add PAY and INV. Check writing, invoicing, integrated AR and INV are useful functions.
MODULES: GL General Ledger; AP Accounts Payable; AR Accounts Receivable; PAY Payroll; INV Inventory.		

TASK: Tracking expenses. Maintaining a payroll.

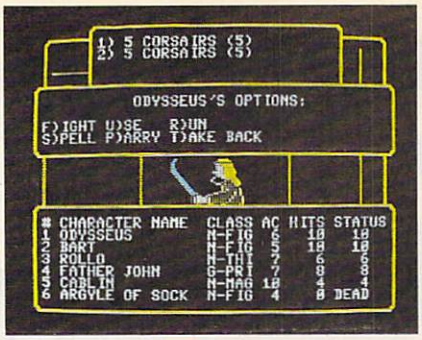
SOLUTION	HOW IT WORKS	FEATURES TO LOOK FOR
Spreadsheet	Rows represent expense types or employees; columns are days or weeks. With payroll, you would need to create formulas to handle deductions.	Any decent spreadsheet will help track expenses. For payroll, report and sort functions give greater ease of use.
Payroll module	Stores data about employees. Produces government reports (i.e., W-2), prints paychecks with deductions listed, and posts to general ledger.	Federal and state tax tables that can be updated when necessary. Can track hours worked by employee or department.

TASK: Control an inventory of goods.

SOLUTION	HOW IT WORKS	FEATURES TO LOOK FOR
Data base	Most commonly, each record would be an item in the inventory, with each field some fact (such as a part number) about the item.	Complete reporting, with arithmetic capabilities, essential. Relational data bases needed for complex inventories.
Spreadsheet	Create "lookup tables" to list item numbers and values, then enter quantity on hand. Lookup command can then find data for inventory value.	Ability to link spreadsheet with another one set up as a GL. Find one that makes full use of your computer's memory.
Inventory module	Besides tracking goods, the best monitor reorder levels, and print packing lists, price labels, and worksheets to help with eyeball inventories.	A report function that highlights overstock, shrinkage, and can sort by multiple criteria. Enough room for data.

A POPULAR ADVENTURE GAME STRENGTHENS A FATHER-SON RELATIONSHIP

BY JAMES L. MOUNT



The Real-Life Magic of *Wizardry*

When my two eldest sons were teenagers, the three of us enjoyed playing basketball in the backyard and watching Sunday football games on television. That was nearly 15 years ago. Today, my third son, J.R., is a teenager, and finding common ground with him is a lot tougher than it was with my older sons. At 49, my lay-up shots aren't as good as they used to be, and I don't like to waste my weekends in front of the tube. And, until very recently, computers made finding common ground with J.R. even rougher.

One of J.R.'s main interests is computers. A couple of years ago, he began learning computer principles in school, and he had both an Atari 2600 and a ColecoVision video-game machine at home. I wasn't at all impressed with the games he'd bought for either machine, since they required the reflexes of youth and an arcade mentality. J.R. had both and I had neither. Hence, J.R.'s enthusiasm for microchips, coupled with my lack of interest, widened an already oversized gap in our relationship. For the life of me, I couldn't figure out how to strengthen our ailing father-son bond.

At about the same time, I realized I should get some hands-on experience in data bases, spreadsheets, and word processors to help with my job as a medical-group manager. I could think of only one solution: a computer at home (which meant more games for J.R.).

I reluctantly bought J.R. one game, *Julius Erving and Larry Bird Go One-On-One*, by Electronic Arts, as an acknowledgment that youth and reflexes must be served. J.R. attacked the game and, within a month, was beating both Julius Erving and Larry Bird and shattering backboards. The glamour and challenge of the game had vanished. Against my wishes, our priest, who also had an Apple IIe, loaned J.R. an adventure game called *Wizardry*, from Sir-Tech Software. As I expected, J.R. began to focus all of his attention on *Wizardry*.

One night, as I was getting ready to use *AppleWorks*—a combination word processor, spreadsheet, and data base—I watched J.R. play *Wizardry*, and noticed that his characters kept ending up in the cemetery. After about a dozen attempts, he became too frustrated to continue and talked to me about it. J.R.'s problem with the game was typical: He charged head on into the action part of the game and got clobbered every time out. I'm an advocate of "when all else fails, read the directions," so J.R. and I read the *Wizardry* manual. Somehow, the manual hooked me. Soon, we were both working our way through *Wizardry*.

Our computing priest accelerated our progress and added fuel to our enthusiasm when he bought us a book of hints and maps for *Wizardry*. By this time, school was out and, with help from the maps, J.R. moved freely through *Wizardry*'s maze. I received daily reports on new monsters with awesome powers and new treasures that healed wounds. Then, in the June 1985 issue of FAMILY COMPUTING, we finally got the hint we needed to finish the game. The adventure had lasted two months.

After *Wizardry*, we went on to *Legacy of Llylgamyn*, also created by Sir-Tech. With no hints, but a set of maps to work from, J.R. finished the game in two weeks.

It was then that I realized how much J.R. had grown. I saw that he had sharpened his problem-solving skills, gained proficiency in typing, learned patience, and improved his reading and comprehension skills by researching computer magazines for hints on *Wizardry* and other games. Since then, he's also learned to use *The Print Shop* (by Broderbund Software) and *AppleWorks*, and has been continually expanding his interests in both games and in educational software.

More important, J.R. and I now discuss computer applications to help him do his schoolwork, and he inquires about the work for the medical center I do at home. I find myself peeking over J.R.'s shoulder whenever I see him at the computer, and encouraging him to pursue his interest in computers. Even our relationship away from the computer has been touched by *Wizardry*. We've been shooting a lot more hoops together these days. FC

JAMES L. MOUNT, *who lives in Sylva, North Carolina, is a* FAMILY COMPUTING *reader. This is his first article for the magazine.*

James Mount and his 14-year-old son, J.R.

Adventure Games Help Children Learn To Think

Some educators and consultants advocate adventure games, such as *Wizardry*, as thinking tools for children. "Adventure games can cause children to think and develop divergent thinking strategies," says Dr. Lee Droegemueller, director of the University of Arizona's educational microcomputer lab and a corporate consultant for Tandy Corp.'s educational division. He points out that adventure games let children develop their own strategies and thinking styles as they work their way through the adventure. "A certain amount of logic is needed to get a positive response from the game, so one's imagination as well as some types of patterns are developed in terms of getting the responses the game is soliciting," says Droegemueller.

To achieve the full benefits of an adventure game, Droegemueller says that parents should provide their children with materials such as books and magazine articles that give hints and tips for solving the game.

BUYER'S GUIDE TO PRINTERS UNDER $600

CHOOSE A HIGH-SPEED (DOT-MATRIX) PRINTER FOR GRAPHICS AND VERSATILITY; OR A LETTER-QUALITY (DAISYWHEEL) PRINTER FOR FORMAL CORRESPONDENCE

BY ROGER HART

Your computer is a lot more interesting when you can see the fruits of your labor. With a video display, you can observe your digital creations, and that's a big part of what makes computing so exciting. It's for this reason that printers are so popular—and necessary. Word processing, the most popular use for personal computers, simply isn't practical if you don't end up with a printed page, or "hard copy." And programs such as *Print Shop* (Broderbund), *Newsroom* (Springboard), and *PageMaker* (Aldus Corp.) have become big sellers primarily because they allow you to print out things you couldn't do with a typewriter.

So, if you don't own a printer or you're in the market for a new one, take a look at the two most popular kinds of printers—impact dot-matrix and daisywheel. Dot-matrix printers are fast and versatile, and nearly all can print graphics. If you want to print out birthday cards, invitations, newsletters, pie charts, or anything that requires graphics and/or different type styles, you should look primarily at dot-matrix printers.

Daisywheel printers, more commonly known as "letter-quality" printers, are slower, but are good for more formal correspondence. If you're running any kind of business from home—especially a word-processing business—you certainly need a good daisywheel printer.

Every printing device must leave a mark on the paper. Thermal-transfer printers do it with wax, ink, and heat. (Many of the new color printers are thermal-transfer; see "Color Printers" in the February 1986 issue.) Laser printers make their marks with light beams. Ink-jet printers do it with black ink or powder.

The two kinds of printers we are concerned with—daisywheel and impact dot-matrix—use ribbons just like typewriters. And both are "impact" printers, leaving an imprint when a printhead strikes a ribbon against paper. But the *way* the ribbon is struck differentiates the two types of printers and what they can accomplish.

DAISYWHEEL PRINTERS

Daisywheel printers use a type element similar to that on the striking end of a typewriter. All characters—letters, numbers, and punctuation marks—are attached like the petals on a daisy, hence the name "daisywheel." To print a certain character, the wheel positions the proper character ("petal") in front of the ribbon, and a tiny hammer strikes the petal against it.

Of course, all this activity takes time and makes noise. There's a mechanical limit to how fast the daisywheel can position the proper petal. Daisywheels in the lower price ranges are relatively slow—12 to 25 characters per second (cps). This equals 100 to 200 words per minute—pretty speedy for a typist, but slow for a computer printer.

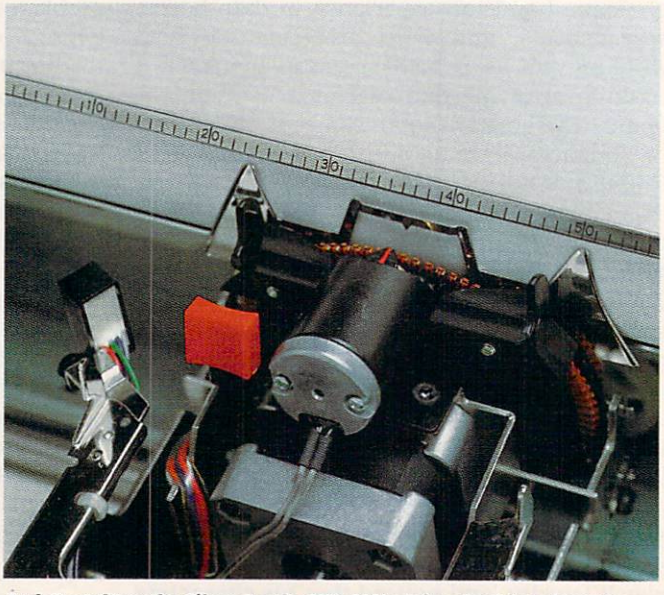
The banging of the hammer against the petal—the impact—also means that daisywheel printers are rather noisy. For all this, daisywheel printing does look good, as good as typewriter printing. It should. After all, it's the same basic technique.

However, while you can't change the style of type on most conventional typewriters, you can on daisywheel printers. Most have a number of different daisywheels that can be used interchangeably, and usually come with one whose typestyle is designed to look just like standard typewriter print. Others can be purchased that will print in script or other styles, such as italic or condensed.

The standard number of characters per daisywheel is 96, which includes uppercase and lowercase letters, numbers, and the hyphens, apostrophes, and colons that you find on most keyboards.

IMPACT DOT-MATRIX PRINTERS

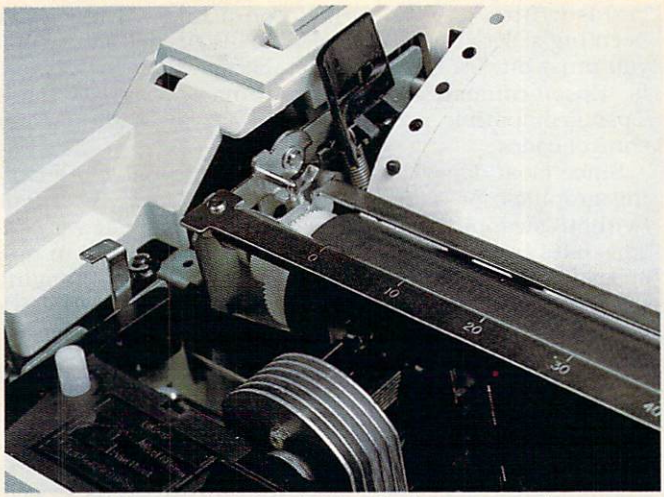
Your local newspaper uses many tiny dots to make up the photographs it prints. Similarly, with dot-matrix

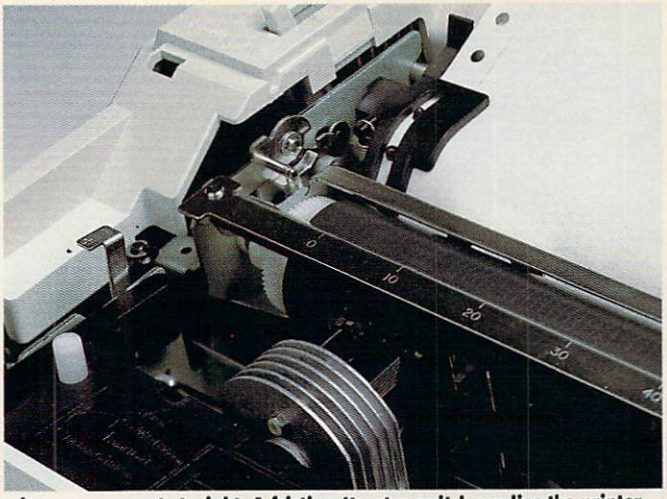


PHOTOGRAPHS BY PHILLIP H. SEYMOUR

Each "petal" on the Silver Reed's EXP 400's daisywheel is a character. The daisywheel can be changed.

ROGER HART, *who lives in New Hampshire, wrote "Color Printers" in the February 1986 issue.*





With the Juki 5510's rear tractor-feed mechanism, you can align paper and hold it with a clamp before you spin it around the platen. The paper always comes out straight. A friction/tractor switch readies the printer for single-sheet or continuous-form paper.

printing, each character is formed using a series of tiny dots. Most dot-matrix printers use printheads containing seven or nine wires or pins, each aligned vertically. Many of the newer dot-matrix printers have as many as 24 pins on a printhead; the more pins, the less space between the dots, and thus the better the print quality. As the printhead passes across the paper, wires are "fired" toward the ribbon in the appropriate pattern, causing the ink to mark the paper with the proper character.

Because dot-matrix printers arrange dots in a variety of patterns, they can print in a variety of styles. While you can print, say, italics on daisywheel printers, you have to change daisywheels to do so. Italics, boldface, outline, and script are possible on many dot-matrix printers. Of course, your word-processing software must be able to trigger the proper printer "control codes" to get these onto the paper.

If a dot-matrix printer goes back over the same line again, the letters become darker and easier to read. This style is generally called "doublestrike," or enhanced mode. Correspondence mode, or near-letter-quality (NLQ), advances the paper or printhead slightly in some printers before making a second pass to fill in the space between dots, thus making the letters appear more solid or rounded. Both correspondence and near-letter-quality modes can be quite good, almost as good as the typewriter quality of a daisywheel printer. Note: Emphasized and enhanced modes are generally not as good as NLQ, but are darker and easier to read than the regular mode (draft).

In addition, because dot-matrix printers use dots to form characters, they can print graphics—something that daisywheel printers can do only in primitive form. If graphics (for pie charts, drawings, etc.) are important to you, a dot-matrix printer is the way to go. However, the software you use must be designed to support your particular printer's graphics codes.

Finally, impact dot-matrix printers are fast, up to 10 times the speed of daisywheels. Those in the chart range from 50 cps to 300 cps. Printing in near-letter-quality mode, however, drops the speed to a third or fourth of the high-speed "draft" mode.

HOOKING IT UP

Hooking up your printer to your computer is a potentially troublesome activity. Here's a description of the two principal ways that your computer transmits information to a printer:

The parallel connection, also called "Centronics" after the company that popularized it, is generally regarded as the least troublesome interface. A parallel printer cable has over 20 separate wires, eight of which carry in parallel a single "bit" part of the eight-bit "byte" that represents the character to be printed. If your computer has a parallel port, and the printer uses a parallel interface, odds are good that the hookup will be a cinch.

The other popular connection is the serial interface, also called "RS-232C." A serial cable carries data "single file" down a single wire to the printer, in the same fashion that Morse code is sent to a receiving station. With

TYPEWRITERS AS PRINTERS

The modern electronic typewriter is basically a daisywheel printer with a keyboard attached. Now, a host of manufacturers—Adler, Brother, Casio, IBM, Olivetti, Silver Reed, Smith Corona, and Sears-Roebuck—sells typewriters with computer interfaces attached. You can connect these typewriters to your computer, and use them as printers. The question is, does this setup make sense?

First of all, realize that the typewriter/printer has the same advantages and disadvantages a daisywheel printer has. The typewriter's output is, of course, "letter-quality"—the quality printers try to match. But, like the daisywheel printer, the typewriter/printer is slow, and doesn't do graphics. Beyond this, the typewriter/printer has its own pluses and minuses.

On the plus side, an electronic typewriter is handy for addressing a single envelope—a Herculean feat on most computer printers. Of course, you can address the envelope or type up anything else independently of your computer. You can take the typewriter to another room or across the country; it works anywhere there's an electric outlet. (Note: You can buy a $225 keyboard to go with the Brother HR-15XL daisywheel printer that, in effect, turns the printer into a typewriter, although an unwieldy one!)

On the minus side, most electronic typewriters aren't as sturdy as daisywheel printers, and could give you trouble over the long term if used a lot. Typewriter/printers are really best suited for occasional, light-duty work loads. Besides, a typewriter with a computer interface is often considerably more expensive than a printer. For instance, the interfaces needed to connect typewriters to computers can cost well over $100.

Finally, many users report problems getting software to work with their typewriter/printers because the software isn't preprogrammed to work with them.

So, do typewriter/printers make sense? If you don't have a computer now, but plan to buy one, you can buy an electronic typewriter to use until you need to turn it into a printer—and take your chances. If you already own an electronic typewriter and plan to buy a computer, you'd be wise to inquire if a computer interface is available for your typewriter. Otherwise, stick with a computer printer.

The Apple ImageWriter II has easy-to-reach control buttons that let you switch between draft and NLQ print modes.

serial transmission of data to the printer, each bit arrives, one after the other, until there are enough for the printer to recognize a full byte, or character.

Serial connections for printers have several drawbacks. For one, it seems that no two serial ports or cables are alike, so you'll have to keep trying until you find a cable that hooks into your computer on one end and your printer on the other. Second, since serial ports and cables can be used for a variety of peripherals besides printers, the wires in the cable that carry bits often have to be switched, much like tuning a radio to the right frequency. Third, if you want to use a modem, which generally uses the serial port, you won't be able to have both printer and modem connected to your computer at the same time (unless your computer has two serial ports, like the Apple IIc and Macintosh).

Often, the easiest solution to the interface problem is to buy a special cable/interface sold with the printer for your particular brand of computer. Epson's Printer Interface Cartridges (PICs) are an example of such interfaces. Many popular computers can't use either the standard Centronics parallel or RS-232C serial connectors. These computers include the Apple IIc and Macintosh, the Atari XE/XL line, Commodore 64/128, and Tandy Color Computer. If you own one of these, look for a printer that is available with a specific interface made for your computer. We note in the chart printers sold with computer-specific cables.

SOFTWARE COMPATIBILITY

Determine if you need print features like bold or italic typestyles, or subscripts (H_2O) and superscripts (x^{10}). Then make sure that: 1. your software can generate these styles; 2. your printer can print them; and 3. your software can send the proper "control codes" to your printer. Characters in these different styles are formed when the printer receives special print codes from your computer's software.

Light bulbs are uniform enough that every brand will fit a standard light socket. Unfortunately, there's considerably less standardization for computer printer codes, which can be frustrating.

Software that can be used with a wide range of printers (Epson, Okidata, C. Itoh, NEC, etc.) will eliminate this particular source of irritation. Many programs allow you to "install" a printer of your choice with its own control codes. Ideally, of course, you won't then have to go through the sometimes tedious setup procedures, figuring out what code will print what type of character.

Much software (especially for Apple and IBM computers) is written to work with Epson printers, which have been big sellers for several years. This doesn't mean that you must buy an Epson printer. Since so much software is "Epson-compatible," many manufacturers have made Epson-compatible printers that share the same printer control codes.

Since most daisywheel printers are incapable of printing graphics, or altering the size or style of their type (without swapping daisywheels), there may be fewer control codes to worry about. But if you're interested in *any* special features (underlining, for example, or changing from 10 characters per inch to 12), you should check whether your software supports a particular printer. (Daisywheel printers don't use Epson control codes.)

CHOOSING YOUR PRINTER

Everyone has a unique combination of printer needs. Take the time to analyze your specific requirements carefully and remember to consider your future needs as well. Here are a few items to consider:

Price. The prices in our chart are list prices, but these printers often can be found selling for less. If you're buying your first printer, however, buying sight unseen through mail order to save money is not recommended. You should see the printer in action, try loading paper, and test it with some software you're likely to use.

In general, the higher-priced printers are faster. Where speeds are comparable, the higher-priced printers are likely to be sturdier, better made, and easier to use. In many cases, this means the printer has front-panel buttons, so you can control the printer without fiddling with hidden DIP switches. And it often means that loading paper into the printer is easier.

Paper loading. On some printers, loading paper is a painful, frustrating experience. Unfortunately, there's no one factor we can point to that makes paper-loading easy; you just have to try a few printers to get the feel of it. It's important that you feel comfortable loading paper into your printer, because it tends to run out of paper in the middle of big jobs when you're frantic to finish (just when you *don't* want to spend half an hour coaxing paper into the beast).

Friction feed. You're probably used to seeing fanfold computer paper with rows of holes on the sides. This "continuous-form" paper is designed to fit over the pin-feed or tractor-feed mechanisms found on most dot-matrix and many daisywheel printers. However, on many

MANUFACTURERS

Apple Computer Corp., 20525 Mariani Ave., Cupertino, CA 95014; (408) 996-1010. Axiom Corp., 1014 Griswold Ave., San Fernando, CA 91340; (818) 365-9521. Brother International Corp., 8 Corporate Place, Piscataway, NJ 08854; (201) 981-0300. C. Itoh Digital Products, Inc., 19750 S. Vermont Ave., Suite #220, Torrance, CA 90502; (800) 423-0300. Commodore Business Machines, Inc., 1200 Wilson Drive, West Chester, PA 19380; (215) 931-9100. Dataproducts, P.O. Box 746, Woodland Hills, CA 91365; (818) 887-8000. Epson America, 2780 Lomita Blvd., Torrance, CA 90505; (800) 421-5426. Hattori Seiko, 1111 McArthur Blvd., Mahwah, NJ 07430; (201) 529-4655. IBM, 100 Westchester Ave., White Plains, NY 10604; (800) 426-2468. Juki Industries of America, 299 Market St., Saddle Brook, NJ 07662; (201) 368-3666. NEC Home Electronics (USA) Inc., 1401 Estes Ave., Elk Grove Village, IL 60007; (312) 228-5900. NEC Information Systems, Inc., 1414 Massachusetts Ave., Boxborough, MA 01719; (617) 264-8000. Okidata, 532 Fellowship Road, Mt. Laurel, NJ 08054; (609) 235-2600. Panasonic Co., 1 Panasonic Way, Secaucus, NJ 07094; (201) 348-7000. Protecto Enterprizes, 22292 N. Pepper Road, Barrington, IL 60010; (312) 382-5244. Silver-Reed America, Inc., 19600 S. Vermont Ave., Torrance, CA 90502-1179; (800) 421-4191. Star Micronics, Inc., 200 Park Ave., New York, NY 10166; (212) 986-6770. Tandy Corp., One Tandy Center, Ft. Worth, TX 76102; (817) 390-3300.

occasions you won't want to use run-of-the-mill computer paper, but your own special letterhead or some other kind of single-sheet paper.

To use single-sheet paper, your printer must have a friction-feed mechanism, which is really a typewriter-style platen with rollers that press firmly enough to hold a piece of paper. Buying a printer with pin- or tractor-feed *and* friction-feed mechanisms makes sense, since you have more versatility.

Bidirectional. "Characters per second" indicates the speed at which the printhead moves across the page, but it isn't the only factor contributing to a printer's overall speed. Some printers print in only one direction. Even if they have a high cps rating, the carriage return, or the time it takes to move from the end of one line to the beginning of the next, slows them down. However, many printers nowadays are bidirectional: they print one line from left to right, and the next line from right to left. Bidirectional printers are faster.

Carriage width. Most of the printers in our chart have a standard typewriter-size carriage that prints 80 characters across (132 in condensed type). However, if you plan to print out spreadsheets often, many of which don't fit in 80 or 132 characters, it might be worth your money to buy a more expensive printer with a wider carriage. FC

DOT-MATRIX PRINTERS (UNDER $600)

COMPANY	MODEL	PRICE	SPEED (cps)	NLQ	ITALICS	INTERFACES	PIN/TRACTOR FEED[7]
Apple	ImageWriter II[3]	$595	250	45 cps	Y	APc, APe, Mac	Incl.
Brother	M-1009	$249	50	N	N	P and S	Incl.
	M-1109	$269	100	25 cps	Y	P and S	Incl.
	M-1509[2]	$499	180	45 cps	Y	P and S	Incl.
C. Itoh	ProWriter Jr.	$329	105	20 cps	Y	P or S	Incl.
	ProWriter 8510[3]	$499	180	45 cps	Y	P or S ($629)	Incl.
	Riteman C+	$329	105	20 cps	Y	COM	Incl.
	Riteman II	$499	160	32 cps	Y	P; S opt. ($70)	$49
	ProWriter C-310	$599	300	50 cps[4]	Y	P or S	Incl.
Commodore	MPS 802	$239[1]	60	N	N	COM	Incl.
Dataproducts	8010	$499[1]	180	30 cps	Y	P and S	Incl.
Epson	JX-80[3]	$399	160	N	Y	P; S opt. ($102)	Incl.
	Homewriter 10	$299[1]	100	16 cps	Y	APc, AT, COM, or IBM PC*jr*	$30
	Spectrum LX-80	$299	100	16 cps	Y	P	$40
	Spectrum LX-90	$389[1]	100	16 cps	Y	P, APc, or IBM PC/PC*jr*	Incl.
	AP-80	$379	75	15 cps	Y	S	Incl.
	FX-85	$499	160	32 cps	Y	P; S opt ($102)	Incl.
Hattori Seiko	SP-1000	$299	100[6]	20 cps	Y	P, S, COM[1], IBM, or Mac and APc; S opt. ($65)	Incl.
IBM	Proprinter	$549	200	40 cps	N	P; S opt ($99)	Incl.
Juki	5510[3]	$499	180	30 cps	Y	P or S	Incl.
NEC Home Electronics	PC-PR-105A	$399	92	46 cps	Y	P	Incl.
Okidata	120	$269[1]	120	30 cps	N	COM	Incl.
	Microline 182	$299	120	30 cps	N	P or IBM; S ($359)	Incl.
	Microline 183[2]	$549	120	30 cps	N	P or IBM; S ($628)	Incl.
	Microline 192	$499	160	33 cps	Y	P or IBM; S ($578) or AP ($529)	Incl.
Panasonic	KX-P1090	$299	96	N	Y	P or S	Incl.
Protecto	ComStar 10X	$148	120	N	Y	P; COM; APe or AT; IBM	Incl.
	ComStar 160	$279	150	80 cps	Y	P; COM; APe or AT; IBM	Incl.
Tandy	DMP 105	$200	80	N	N	P and CoCo	Incl.
	DMP 130	$350	100	24 cps	N	P and CoCo	Incl.
Star Micronics	SG-10	$299	120	40 cps	N	P; S opt. ($100–$127)	Incl.
	SG-15[2]	$499	120	40 cps	N	P; S opt. ($42)	Incl.
	SD-10	$449	160	50 cps	N	P; S opt. ($115)	Incl.
	SD-15[2]	$599	160	50 cps	N	P; S opt. ($39)	Incl.

DAISY WHEEL PRINTERS (UNDER $600)

COMPANY	MODEL	PRICE	SPEED (cps)	NO. WHEELS	NO. CHARACTERS	INTERFACES	PIN/TRACTOR FEED
Axiom	DX 1500	$349	14	23	96	P	$42
	DX 2000	$449	22	23	96	P	$47
Brother	HR-10	$349	12	31	96	P or S	Incl.
	HR-15XL	$599	17	31	96	P or S	$140
C. Itoh	StarWriter Y10-20	$549	22	100+	96	P or S	$199
Epson	DX-10	$299	10	100+	96	P	$ Not avail.
	DX-20	$459	20	100+	96	P and S	$ Not avail.
Juki	6000	$295	10	6	100	P or S	$149
	6100	$599	18	18	100	P or S	$149
NEC Info. System	Spinwriter elf	$545	19	80	128	IBM (elf 350); P and S, Mac[5] (elf 360)	$99–$150
Silver Reed	EXP 400	$249	12	8	96	P or S	$109
	EXP 500	$349	16	8	96	P or S	$149
Tandy	DWP-220	$599	20	3	100	P and CoCo	$119

[1]Interface module and/or cables included. [2]Wide carriage printer. [3]Color ribbons available.[4] 33, cps in letter-quality mode. [5]May be interfaced with Macintosh using accessory kit ($100). [6]Macintosh and Apple IIc version prints 75 cps in draft or 15 cps in NLQ mode. [7]Pin or tractor paper feed is extra where price is indicated. Friction paper feed is standard on all printers.

NLQ near-letter-quality printing mode; **No. Wheels** Number of daisywheels available; **No. Char.** Number of characters on daisywheel; **APc** Apple IIc; **APe** Apple IIe; **AT** Atari; **COM** Commodore 64/128; **IBM** International Business Machines; **Mac** Macintosh; **P and S** Both parallel and serial interfaces are included with printer; **P or S** Buyer must specify parallel or serial interface at time of purchase; **CPS** Characters per second.

HANDS-ON REVIEW:

LEADING EDGE MODEL "D"

A LOW STICKER PRICE, AND LOADED WITH OPTIONS

BY PHIL WISWELL

Even though many people buy IBM PCs for the home, IBM itself positions the PC as a business machine. It's priced that way. As with buying cars, where you are charged extra for each option you add to the basic model, the initial IBM sticker price is a far cry from the final sales tag. You even pay $85 extra for PC-DOS, the operating system without which you can't run software.

Now, you can buy a computer with all the power, speed, and flexibility of an IBM PC, that's loaded with options. The list price of the basic model is not only much lower than IBM's, but it delivers all the options most users want when they drive off the showroom floor.

The computer is the Leading Edge Model "D," and it runs virtually all IBM software. The price—for 256K, two floppy-disk drives, a monochrome monitor, and all the interfaces most people need (except a joystick port!)—is $1,495. An equivalently equipped IBM PC would cost about $2800 in an IBM Product Center. Other configurations of the Model "D" are equally good deals. For $1895, you get an RGB color monitor with the system or a monochrome monitor and a 20-megabyte hard-disk drive.

Leading Edge is not a household word because it has rarely used the company name on its brands. In the past, Leading Edge has marketed the Banana printer (made by C. Itoh), the Gorilla monitor, and Elephant floppy disks. The "D" in Model "D" stands for Daewoo, the huge Korean industrial tractor- and shipbuilder that actually makes the computer. Leading Edge also sells the Leading Edge Model "M" (not to be confused with the "D"), one of the less successful IBM compatibles, the *Nutshell* information manager and filer, and the *Leading Edge Word Processing* program (with spell checker and mail-merge capability), which comes free when you buy the Model "D."

PHIL WISWELL, *a freelance writer and small-business computer consultant, wrote the* Buyer's Guide to IBM Compatibles, *in the March issue.*

KICKING THE TIRES

It's easy to tell the Model "D" and IBM PC apart from the outside: the Leading Edge system unit is narrower by a full five inches, and features a more stylish, less industrial design. The Model "D"'s disk drive doors can be "locked" closed with a sliding switch so you can't inadvertently open the drive while it's whirring. Another nice touch is the sculptured tray above the number keys that keeps your pencil from rolling away.

The power switch for the Model "D" is in front, rather than near the back as on the IBM PC, making the machine easier to turn on and off. Just below the power switch is a RESET button—an accessible position, but dangerously close to the second disk drive where your data disk resides. It's possible to reset the computer accidentally. In fact, my four-year-old son John did just that while I was writing this review, and it cost me two unsaved paragraphs.

The keyboard cable plugs into the front of the computer. You can move the keyboard at least six feet from the system unit in any direction, so you have the freedom to sit back in your favorite chair, keyboard on lap. And this keyboard weighs about one-half as much as IBM's. It feels more like a large book than a large brick. The Leading Edge screen display is extremely sharp and readable from a distance.

Keyboard. The Model "D" keyboard has 83 keys, same as the IBM PC. These include 10 FUNCTION keys, a numeric keypad, PgUp (to move the cursor a "page up") and PgDn (to move a "page down") keys, and a PrtSc ("print screen") key that prints whatever's on the screen.

In addition, Leading Edge listened to criticisms about the IBM keyboard and rearranged the layout so it's more like the standard IBM Selectric typewriter keyboard. The SHIFT, TAB, BACK SPACE, NUM LOCK, SCROLL LOCK, CAPS LOCK, INSERT, and DELETE keys are double-width, and the ENTER key is shaped like a large backwards "L"—all of which make typing smoother and faster than on the IBM PC keyboard. Little "braille" dots on the F and J keys (and 5 key) help your fingers find the typist's "home row" without looking down. Besides these improvements, the only other difference between the two keyboards is that the backslash (/) and tilde (~) keys have new locations on the Model "D" keyboard.

For all this, I will admit a slight preference for the feel of the IBM keyboard. The Model "D" keyboard feels less firm to the touch.

LOOKING UNDER THE HOOD

Okay. The Model "D" and the PC look substantially different from the outside. Let's pop open their hoods to compare "standard factory options."

Remove the Model "D"'s system unit cover (with a screwdriver) and you find all four full-length expansion slots empty. Where's the monochrome graphics adapter? The color graphics adapter? The printer adapter? Configuring an IBM PC for monochrome or color display plus a printer requires an expansion board or two for which IBM charges extra money. (And IBM eats up one more of its five expansion slots with a disk drive controller card.) On the Model "D," all these extras are built into the main system motherboard, leaving the four

expansion slots open.

Interfaces. Leading Edge gives you both monochrome and color graphics adapters, a parallel printer port, an RS-232 serial port, and a clock/calendar—all at no charge above the sticker price on the windshield. The only major peripherals you can't plug in without adding an interface are joysticks and external hard-disk drives.

You can also add extra memory (RAM) to the motherboard, instead of using up an expansion slot. Leading Edge's Operator's Guide gives details and diagrams on how to upgrade RAM to 640K yourself, either by placing chips on the motherboard or by installing a third-party memory expansion board.

If my experience is any guide, you should have little worry that expansion boards designed for the IBM PC will work properly on the Model "D." The expansion boards I tested—including AST's Six-Pak Plus, Quadram's Gold Quadboard, and Koala's game controller card—all worked to perfection.

The biggest difference between the two computers "under the hood" is the space available for disk drives. The basic IBM PC comes with room for two full-height floppy disk drives side by side. This configuration means you have room for up to four half-height drives—and can put together combinations of floppy-disk drives, hard-disk drives, and tape backup devices inside the IBM machine.

Disk Drives. The Leading Edge Model "D" comes with two half-height floppy-disk drives (360K storage each) stacked on top of one another. There is no more room for adding a third and fourth disk drive—either floppy- or hard-disk—inside the system unit. (The Model "D" hard-disk system substitutes a hard disk for one of the floppies. Unfortunately, some dealers install third-party drives, which voids the Leading Edge warranty.) Of course, external drives can be added.

Monitor. The Leading Edge includes a very clear, 12″ monochrome (green or amber) monitor at no extra charge to the already attractive list price. The monitor is every bit as good as IBM's comparable model, (even sharper, according to Leading Edge), which will cost you $275 extra. If you want the best of both worlds—80 columns for text work *and* color—you can buy the Leading Edge RGB color monitor instead. You don't need an extra expansion board—just plug in the RGB. (I haven't seen this monitor. I used the IBM Color Display.) A switch on the Model "D"'s rear panel allows you to toggle between monochrome and color displays, if you have two monitors attached at once.

TEST-DRIVING

The Model "D" boots quickly from a cold start—just over 20 seconds including the POST (pre-operative self-test), which checks the 256K RAM before giving the green light to DOS. Without going into technical details, this POST function is necessary to ensure accurate performance from DOS and other programs.

From the driver's seat, the Leading Edge Model "D" performs and handles just like an IBM PC. The Model "D" operates under MS-DOS 2.11, which uses the same commands as IBM's PC-DOS. The two operating systems differ slightly, but not in any way that affects the user.

Software. I ran the Model "D" through every software test I could think up, beginning with the operation of many different kinds of commercially available programs. The programs that ran flawlessly are: *Lotus 1-2-3*; *dBASE II* and *III*; *SideKick*; *Prokey*; *ThinkTank*, *XyWrite II+*, *Microsoft Word*; *Word Perfect*; *MultiMate*; *DisplayWrite 1*, *2*, and *3*; *Bank Street Writer*, *PFS:Write*, *File*, *Report*, and *Plan*; *WordStar 2000*; *Power-Base*; *Mastering the SAT*; *Success With Math*; *The Print Shop*; *The Hitchhiker's Guide to the Galaxy*; and *King's Quest* (with a color monitor).

Next, I decided to see how the Model "D" would behave running under PC-DOS rather than the MS-DOS disk supplied with it. I turned the computer off, booted PC-DOS 2.1, and ran several of the programs mentioned above, all without problem.

Finally, I tried the acid test—programs written in BASIC or BASICA for the IBM PC. Leading Edge supplies GW BASIC on disk (free of charge), which is slightly different from the BASIC language for the IBM PC. The languages are different enough so that IBM's BASIC won't run many programs written in GW BASIC. However, the reverse does not appear to be true. I ran several IBM BASIC programs under the Model "D"'s GW BASIC without problems.

What you cannot do is run programs that generate graphics on a monochrome monitor, unless they are designed to work with the Hercules graphics card (such as *Lotus 1-2-3*). To run most graphics programs, you need an RGB monitor. If you want to know if a particular piece of software will run, call Leading Edge at 1-800-523-HELP, or collect at (617) 828-8150 inside Massachusetts. Technicians who answer the HELP lines are quite responsive.

MODEL "D" FACTS

LIST PRICE: $1,495.
MEMORY: 256K RAM, expandable to 640K on the motherboard.
DISK DRIVES: Two 360K half-height floppy-disk drives; or one floppy- and one 20 megabyte hard-disk drive ($1,895).
VIDEO DISPLAY: 12″ monochrome monitor (amber or green) included; 19″ RGB color system ($1,895).
RESOLUTION: 720 × 348 monochrome; 640 × 200 color.
INTERFACES: Monochrome graphics and color graphics adapters; parallel and serial ports; clock/calendar.
EXPANSION SLOTS: Four.
KEYBOARD: 83 keys, with 10 function keys and numeric keypad.
SOFTWARE: MS-DOS 2.11, GW BASIC, Diagnostic Disk, *Leading Edge Word Processor*.

IN THE DEALER'S LOT

Well, what do you make of this $1495 computer? Will the Model "D" run software from the enormous IBM PC library? Absolutely, both color and monochrome, and with graphics. Will the Model "D" expand with your needs as well as the IBM does? Yes, with four open expansion slots for expansion cards—unless you find it necessary to have more than two internal disk drives. Will the Model "D" last as long as an IBM and will it break down as infrequently? I can't give a concrete answer, but from my experience under its hood, I believe it is designed for high mileage and few repairs. In addition, Leading Edge offers a 15-month warranty.

Who is the Model "D" for? For those who have long wanted an IBM PC, but have not been able to afford it or wanted to spend the money. And for those who want a powerful computer system that majors in business, but is versatile enough for any and all family needs, including education and entertainment. FC

HELPFUL HINTS

TO GET MORE FROM YOUR COMPUTER

Have you ever wished a computer expert could materialize at your shoulder, a bit like a fairy godmother, and suggest a few hints on how to do something better at the keyboard? Knowing the inside track can go a long way toward helping you get more out of your computer (whether it's an Apple, Atari, Commodore, or IBM), your printer, and the time you spend on-line. So, we asked people we consider experts in the field to pass on a few of their secrets. Check out their hints and enjoy the fruits that come with having the savvy of the pros.

Reminder: Turn off your computer and peripherals before tinkering with them. Parental guidance is highly recommended for young children undertaking these activities.

EDITED BY ROXANE FARMANFARMAIAN

David Hallerman, REVIEWS EDITOR FOR FAMILY COMPUTING

APPLE TRICKS. My Apple IIe and my software library are two of my most valued possessions. That's because I've developed ways of customizing my programs and data files to make them faster and easier to work with. Here are some of the tricks I use to enhance my software files:

Date your data files. If your Apple uses DOS 3.3, ProDOS without a clock, or doesn't date files automatically, you can conquer the system the same way I do. Name your file with just two or three letters and add a period; then type the date as a set of numerals, separating the day, month, and year by periods as well. (For example, I might name a file DAV.5.01.86.) This is particularly useful for keeping chronological tabs on correspondence and updates of database files and reports.

Create your own help screen. If your word processor and/or data base let you view one file while you're working on another—like mine do—you can make up your own help screen or tip sheet for notes. Simply compose a single screen's worth of information for general computer use (reminders for the kids on how to save a file, for instance) or for a particular project. Save the file under a name such as HELPSAVE, and call it up for viewing anytime you need it.

Here's a special trick I use with *AppleWriter* to view a help screen at the same time I'm working on another file. Say I've just developed a series of glossary entries that I don't completely remember yet. I open a new file and write out a list of entries with their functions, making sure I don't exceed one screen's worth of words (23 lines max). I save the file under the name HELP or another filename. I add a back slash (\) after the filename when I load the file to the screen, so it won't overwrite or add itself to my document—it will simply appear on-screen. It's fast and easy and, if you're an *AppleWriter* user, you can do it, too!

Extend your horizons with *Big U*. If your program doesn't let you view two files simultaneously, check out *Big U* (Beagle Brothers, 64K Apple; $35). *Big U* lets you date files on unprotected programs (such as *Apple Access* and *AppleWorks*), and does much more, using 33 utility programs neatly packaged on one disk. If you're a recreational programmer, you'll appreciate the file-moving program that uses very little space and can be used while you're in BASIC to make subdirectories, to transfer files, and to perform other functions. *Big U* will even let you format a disk with extra disk storage space, something that would normally require a hardware change. Want a quick command to copy any file from one disk to another? There's a utility for that, as well as a super menu program utility and a mini word-processing module, too.

John Jainschigg, SENIOR TECHNICAL EDITOR FOR FAMILY COMPUTING

ATARI HINTS. The old Atari 800 served as my introduction to computing and, though I've acquired other machines over the years, the 48K 800 is still my workhorse. In my years of working with the Atari, I've discovered ways to improve system performance when using Atari BASIC or programs with DOS. Here are my favorites:

Speed up your cursor. A slow-moving cursor always bothered me when I was trying to edit a BASIC program—until I found this easy fix.

```
10 FOR I=1536 TO 1575:READ A:POKE I,A:NEXT I
20 PRINT CHR$(125);
30 PRINT "ENTER DEBOUNCE DELAY (1-46)";
40 INPUT DD:IF DD<1 OR DD>46 THEN 30
50 POKE 1576,DD
60 PRINT "ENTER REPEAT SPEED (1-5)";
70 INPUT RS:IF RS<1 OR RS>5 THEN 60
80 POKE 1577,RS
90 A=USR(1536)
100 PRINT "FASTKEY INSTALLED!"
1000 DATA 104,162,6,160,11,169,7,32,92,228
1010 DATA 96,216,173,43,2,201,47,208,8,173
1020 DATA 40,6,141,43,2,208,10,201,6,208,6
1030 DATA 173,41,6,141,43,2,76,98,228
```

Atari 600/800XL and 130XE owners just have to POKE location 729 with a number between 1 and 47 to short-

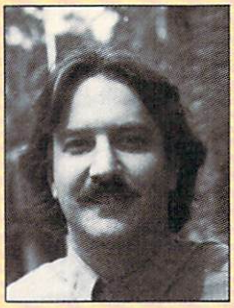
en the "debounce delay," or the amount of time it takes before a held-down key begins repeating; the smaller the number, the shorter the delay. POKE 730 with a number between 1 and 5 to control the repeat speed; again, smaller values let the cursor move faster. To get the same effect on the 400 and 800, carefully type the program on p. 46. SAVE it to disk or cassette and RUN it. Enter a preferred debounce delay value between 1 and 46, and select a repeat rate between 1 and 5. Once the program has been executed, you can enter, edit, and, in most cases, run BASIC programs as you normally would. Your cursor will stay turbo-charged until you press SYSTEM RESET.

Customize DOS. There are also a few POKE commands I use to customize DOS 2.0S or DOS 2.5. Normally, Atari DOS lets you open only three disk files at a time. If you POKE 1801 with a number from 1 to 7, you can decrease or increase the maximum number of files you can open concurrently. Here's a related tip: 128 bytes of RAM is automatically reserved for each file. To save memory, set this maximum to reflect only the number of concurrent files your program will actually use.

DOS verifies (reads back and checks) each byte of data it writes to disk. This slows down SAVEs enormously. To almost double the speed of SAVEs, turn off the "write-with-verify" feature by POKEing 1913 with value 80. Though I've had few problems using DOS without verify, note that this modification will make disk writes less reliable than they were before.

Once you've changed DOS features, be sure to write a copy of your modified DOS to a new disk by typing DOS and choosing option H (WRITE DOS FILES) from the DOS menu. Label the new DOS disk carefully.

If you're a DOS 3 user, you can make the above DOS modifications by typing DOS, selecting menu option I (INITIALIZE DISK), and initializing a bootable disk like this: Enter a Y at the MODIFY FMS PARAMETERS? prompt. Three further prompts will follow, permitting you to enter information about how you wish to modify DOS before writing it to your disk. Don't change the address of the FMS (File Management System) buffers. Change the maximum number of concurrently open files by adding the new maximum (from 1 to 7) to the number of disk drives and entering this sum at the second prompt. Turn off "write with verify" by entering N at the third prompt.



Joey Latimer, ASSOCIATE TECHNICAL EDITOR FOR FAMILY COMPUTING

COMMODORE TIPS. I was noticing the other day that after two-and-a-half years of good, long service, my C 64's keyboard looked played out and in need of a rest. If mine's like that, I figured, other people's might be, too. So, here's my quick, cheap solution for giving a dog-eared keyboard the time off it deserves. Working all these years on the C 64 also means I've found ways to do things that Commodore BASIC doesn't have commands for. I've included one of the most useful.

Replace your worn-out keyboard. If you have a Commodore 64 out of warranty, with a keyboard that's missing keys or has keys that don't work, it might cost a lot to install a new one. My money-saving alternative? Swap your C 64's aging keyboard for a good one from a little-used VIC-20, like I did. Even if you don't have a VIC-20 in the house, you probably won't have any trouble finding a cheap one. Here's how to switch keyboards: First, be sure the computers are turned off. Then remove the Phillips-head screws to separate the top and bottom halves of both computers' shells (*see diagram, below*). Next, remove the screws fastening the keyboards to the shells. Finally, disconnect the connectors between the keyboards and the motherboards (base of the shells). Swap the keyboards, reverse the process, and you'll have an almost-new C 64 keyboard look-alike.

Write anywhere on your screen. I found a great way to position messages, strings, or graphic characters just about anywhere on the screen. Try it!

```
10 PRINT CHR$(147)
20 POKE 214,10:PRINT
30 PRINT TAB(15);"MESSAGE"
```

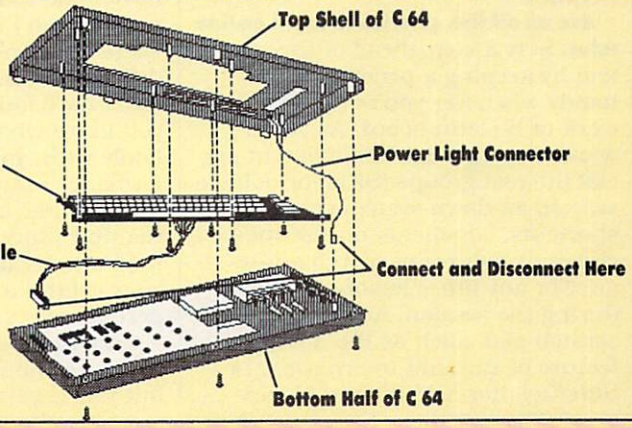
Line 10 clears the screen. Line 20 tabs the cursor down to row 11. Line 30 tabs the cursor 15 columns to the right and prints MESSAGE on the screen. The number POKEd into location 214 (1 to 24) determines the row, while TAB (zero to 39) sets the column.

Phil Wiswell, NEW YORK CITY COMPUTER CONSULTANT

TAMING THE IBM PC AND COMPATIBLES. The IBM PC is not an easy beast to tame. But, once tamed, the beast will perform awesome feats. If you learn to crack your whip, it will always go the extra mile. Here are some tricks of the trade that I've picked up, in my years of experience with these powerful desktop computers:

Link your files together. If you have materials in different text files that you want to compile into one comprehensive file, you can use the COPY command in this manner: Type COPY FILE1+FILE2+FILE3 FILE123. (These stand for your filenames.) This merges FILE2 at the end of FILE1, and FILE3 at the end of FILE2. The combined files are stored under the name FILE123. If FILE123 creates a long, cumbersome name, you can change it to something more convenient. If you stored your files with an extension, such as .TXT at the end of each one, you can use a "global wild card" within the command, such as COPY *.TXT ALL.TXT.

REPLACING COMMODORE KEYBOARD



MACPAINT ILLUSTRATION BY JOHN JANSCHIGG

This will copy all files with the extension .TXT into a single file called ALL.TXT.

Print out your graphics quickly and easily. If you have a color/graphics monitor adapter, you can print out anything on your screen whenever you wish. Put your DOS disk in drive A and type GRAPHICS. Thereafter, hitting CONTROL PRTSCR will dump whatever you have on-screen to your printer for an instant printout. *Note:* This works only with certain dot-matrix printers.

Learn MORE and work less. The DOS TYPE command lets you quickly read through any file you have on disk. However, in order to read the file as it scrolls up your screen, you need to press CNTRL-S to stop and restart the display. I found a better way. Let's say you have a file called MYFILE on your disk. Type MORE <B:MYFILE (if your data disk is in drive B) and press ENTER (or the equivalent key on your compatible). The first screenful of MYFILE will appear, with the message —MORE— at the bottom. Pressing any key will scroll up the next screenful, and so on—a much handier way of viewing a file, one screen at a time. *Warning:* Don't ever type the greater-than-sign (>) by mistake, as this will wipe out your entire file.

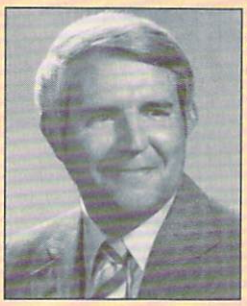
Richard Slatta, TELECOMMUNICATIONS EXPERT AND DIRECTOR OF AN ELECTRONIC NETWORK

ON-LINE STRATEGIES. It takes savvy to negotiate the on-line networks and bulletin boards without wasting lots of time and money. Here are a few techniques I've learned in my on-line travels and as director of my own network.

Use an off-line solution to learn on-line rules. Stay a step ahead of the system by keeping a pencil and pad handy whenever you're up on a network or bulletin board. As you're wandering through the different special interest groups (SIGs) or doing a search, jot down system command shortcuts, comments on the successes or failures of search strategies, or any other lessons you learn during the session. An electronic scratch pad, such as the notepad feature of Borland International's *SideKick* (for IBM PC and Macintosh; $85) is also useful for jotting down quick messages while on-line. Your notes can act as a customized reference card and reminder sheet for future forays—saving you money and time.

Find the right synonym. Have you ever been stumped for a word when doing a search? Use a thesaurus to help you define keywords for searches. Knowing the right synonyms can reduce the number of missed or inappropriate references—and reduce on-line fees. If a word such as "foreign" doesn't help your search, "imported" might. For added speed and convenience, try using a software thesaurus that works in tandem with your word-processing software.

Know all the words. Learn to use words such as AND, OR, and NOT to refine a search strategy. An on-line search for MICROCOMPUTERS AND MODEMS is more precise and limited than a search for MICROCOMPUTERS OR MODEMS. (The latter can be useful, however, if you're trying to identify the title of an article on modems, for example, that included one or the other of the two words, but you can't remember which.) Taken a step further, a search for modems that are NOT HAYES will usually limit your search to non-Hayes brands.



Roger Hart, SPECIALIST IN PRINTERS AND PLOTTERS

MASTERING YOUR PRINTER. Getting your printer and computer to work hand-in-hand can be tricky. Even when the printer is the same brand as the computer, there's the question of software. All three elements have to be synchronized, or your printer won't behave the way you want it to. And since each system is different, each solution is different, too! I have found, however, that if you know what basic elements to fiddle with, you can get a good performance out of most system combinations. Use a day when you have the time (and patience!) to figure it all out—and I'm sure you'll find your printer a most accommodating peripheral.

Choose your printer driver—don't let it choose you. Your printer is working, but you're getting strange characters in the margins, or the printer is spewing out an extra sheet of paper whenever it finishes a document. The problem may be that your software is not correctly driving your printer. Check the list of printers on the "setup" menu and see if yours is listed. Try a few alternatives (even if you think you've chosen the right one), in case another works more cleanly. (I've found, for example, that Epson selections work for all sorts of printers, even daisywheels. Try it!) You won't hurt either your printer or your computer by choosing the wrong printer listing, so go ahead and experiment without worry.

Have you checked your DIP switches? Are you getting double-spaced documents when you want single-spaced ones? Alternatively, is your printer putting everything on the same line, over and over again? The problem is probably the setting of one of your printer's DIP switches. DIP switches are tiny on-off switches that are usually hidden away in the back of your printer. Read your manual to find their location and determine which setting (on or off) is correct for your computer setup. If your computer is suffering from perpetual double-spacing, it means one of the DIP switches is adding a "line feed"—a signal to the printer to drop down a line after each carriage return. You'll need to identify which DIP switch is the culprit (check your manual) and flip it to the "off" position. If your text is piling up on one line, take the opposite tack and flip the appropriate switch to the "on" position.

DIP switches control many other features. If you can't get your printer to skip over your paper's perforations, or to print in sharp "near-letter-quality" mode on your dot-matrix printer, for example, you may be able to solve the problem by resetting a DIP switch or two. There also may be DIP-switch settings that provide entire new sets of characters—even those in foreign languages. A tour through your manual or a call to the manufacturer may present possibilities you never knew your printer was capable of. But be sure you write down the original setting before starting to experiment!

Finding new ways to get more from your computer is part of the fun of having one. Computers are complicated devices with many uses—and many secrets. It takes time to discover and develop efficient ways to work with them. Sharing tricks saves reinventing the wheel. But that's only the one-percent inspiration. The 99-percent perspiration is now up to you! FC

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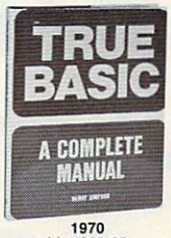

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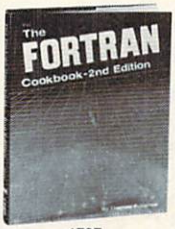

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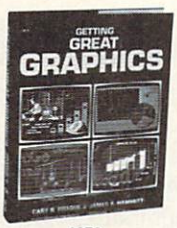

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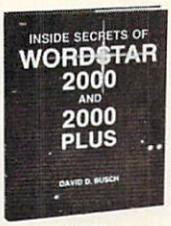

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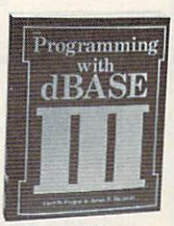

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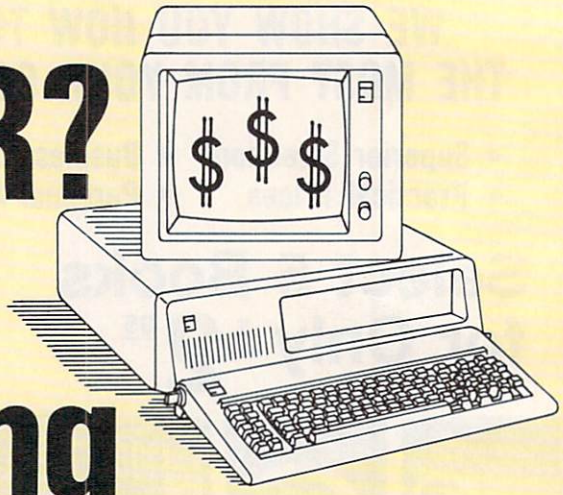

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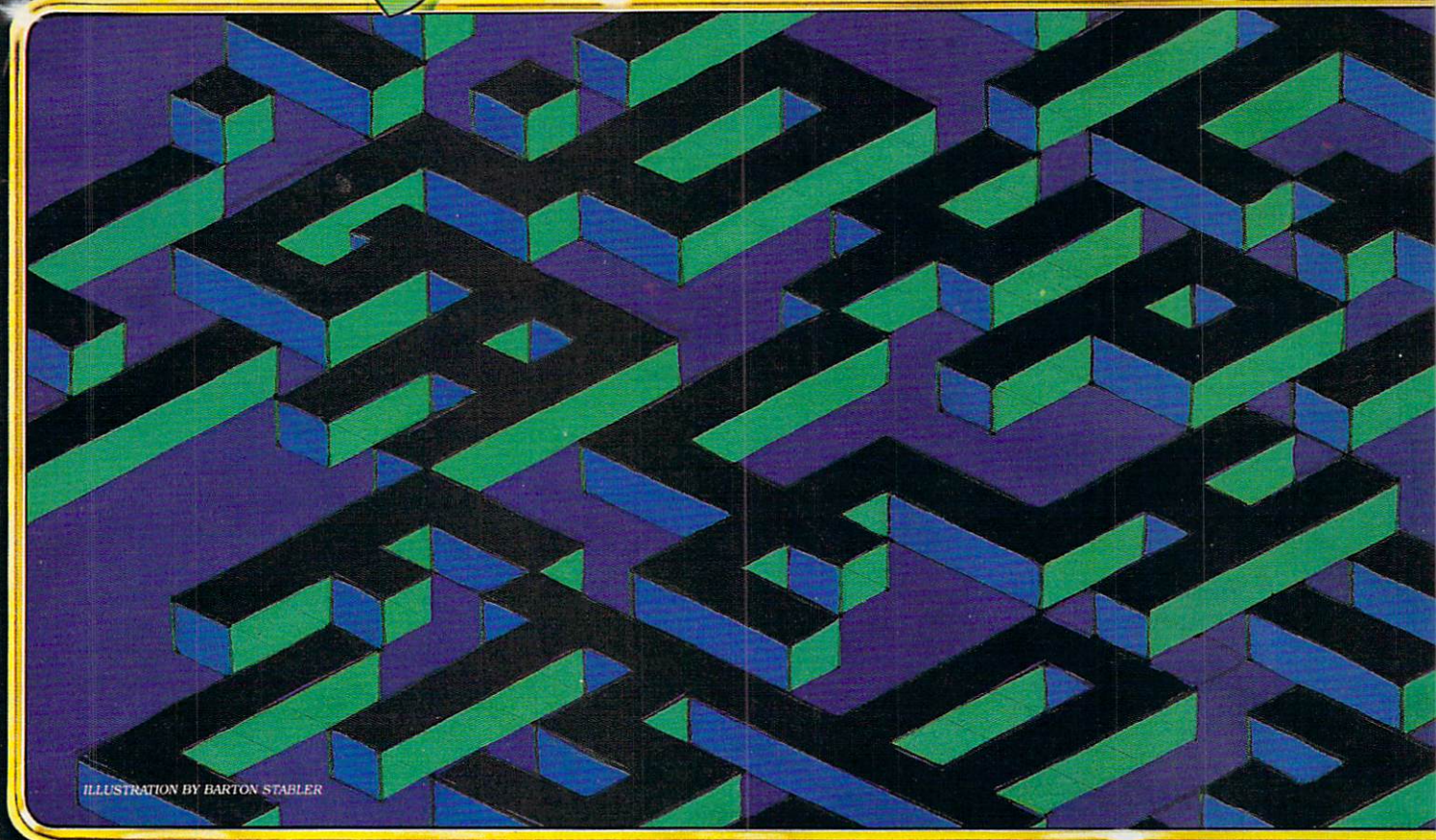

ILLUSTRATION BY BARTON STABLER

★ M A Y ★

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How to type in FAMILY COMPUTING's programs, and what to do if a program doesn't work.

BEGINNER PROGRAM
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Improve your typing speed with *Letter Getter*, and learn to stalk the wily keystroke!

FEATURE PROGRAM
Page 55

Let *Maze Creator* knit up an unlimited number of labyrinths for your unraveling. Explore on-screen, or print your mazes out for fun anytime!

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ILLUSTRATION BY JAMES CHERRY III

LETTER GETTER

BY JOEY LATIMER

Want to improve your typing speed and have fun at the same time? *Letter Getter* is a program that sweetens the chore of typing practice with the fun of gaming. We're not saying *Letter Getter* can teach you how to type—but if you already know which fingers to use, this little program can go a long way toward sharpening your reflexes and shoring up your keyboard skills!

In *Letter Getter*, a randomly chosen letter appears at the bottom of the screen and moves swiftly upward. If you can press the corresponding key before the letter reaches the top, points are added to your score and a new round begins. The quicker your fingers fly, the more points you get. If the letter escapes off the top of the screen, the game is over and you must begin again.

USING *LETTER GETTER*

Type *Letter Getter* into your computer and SAVE it to disk or cassette. Before typing RUN, make sure your keyboard is set to type all capital letters (the program won't recognize lowercase input).

After using *Letter Getter* for a while, you may want more of a challenge. You can increase the game's speed by *decreasing* the value assigned to variable DT (*D*elay *T*imer), set near the start of the program.

PROGRAMMER'S NOTEBOOK: STALKING THE WILY KEYPRESS

When your computer encounters an INPUT expression (e.g., INPUT A$), it displays a "?" prompt and waits for you to type something. Until you press RETURN or ENTER, each character you type is displayed on the screen. Afterward, what you've typed becomes the value of the variable mentioned in the INPUT expression.

But what if you don't want your program to pause or display a "?" each time it "expects" input from the keyboard? What if you don't want a user's typing to mess up your carefully-crafted screen display? For situations like these, special commands and techniques exist to let a program "know" if a key has been pressed—and, if so, which key—without pausing or printing something in the process.

Letter Getter shows these techniques at work in two different ways. During the game, the program is alternating—without pause—between moving a letter up the screen and checking "on the fly" to see if you've pressed a corresponding key. When you're asked to PRESS ANY KEY TO PLAY AGAIN at the game's conclusion, the program waits until you've pressed a single key (it isn't necessary to press RETURN or ENTER) before starting over.

Because techniques differ between computers, we've provided notes for each version of *Letter Getter*, explaining briefly how each version "reads" the keyboard and processes the information coming from it.

Adam/*Letter Getter*

```
10 LOMEM: 29000
20 FOR i = 28000 TO 28005
30 READ a
40 POKE i,a
50 NEXT i
58 REM --"POKE 16953,0" TURNS OFF THE CURSOR--
59 REM --"POKE 16953,95" WILL TURN IT BACK ON--
60 POKE 16953,0
70 dt = 150
80 s = 0
90 HOME
100 CALL 28000
110 ch = INT(RND(1)*26)+65
120 HTAB INT(RND(1)*31)+1
130 VTAB 24
140 PRINT CHR$(ch);
150 i = 23
160 p = PEEK(64885)
170 IF p <> ch THEN 240
180 HOME
190 s = s+i
200 PRINT TAB(15);s
210 FOR de = 1 TO 1000
220 NEXT de
230 GOTO 90
240 FOR de = 1 TO dt
250 NEXT de
260 PRINT
270 IF i > 0 THEN i = i-1:GOTO 160
280 HOME
290 PRINT "Your score was ";s;"."
300 PRINT
310 PRINT "Press any key to play again."
320 GET k$
330 GOTO 80
1000 DATA 62,0,50,117,253,201
```

Each time a key is pressed, its ASCII code is stored in memory location 64885. Line 160 PEEKs this location and saves the value found there in variable p. p is then compared with ch (the ASCII code of the "target" character) to see if you've pressed the right key.

A short machine-language routine is used to "clear" 64885 between rounds so that the final keystroke of one round isn't interpreted as the first keystroke of the next. Line 10 reserves free memory for storing this routine. Lines 20–50 READ numeric machine-code instructions in from the DATA statement (line 1000). 64885 is cleared in line 100, using the expression CALL 28000, which executes the routine stored at this address.

GET k$ in line 320 pauses the program until a key is pressed, then makes k$ equal the corresponding character.

Apple II series/*Letter Getter*

```
10 DT = 150
20 S = 0
30 HOME
40 POKE -16368,0
50 CH = INT(RND(1)*26)+65
60 HTAB INT(RND(1)*38)+2
70 VTAB 24
80 PRINT CHR$(CH);
90 I = 23
100 P = PEEK(-16384)-128
110 IF P <> CH THEN 190
120 HOME
130 S = S+I
140 HTAB 20
150 PRINT S
160 FOR DE = 1 TO 250
170 NEXT DE
180 GOTO 30
190 FOR DE = 1 TO DT
200 NEXT DE
210 PRINT
220 IF I > 0 THEN I = I-1:GOTO 100
230 HOME
```

ILLUSTRATIONS BY JOSH GOSFIELD

```
240 POKE -16368,0
250 PRINT "YOUR SCORE WAS ";S;"."
260 PRINT
270 PRINT "PRESS ANY KEY TO PLAY AGAIN.";
280 GET K$
290 GOTO 20
```

Each time a key is pressed, its ASCII code (plus 128) is immediately stored in memory location −16384. Line 100 PEEKs this location, subtracts 128 from the value found there, and stores the resulting "true ASCII" code in variable P. P is tested against CH, the ASCII code of the "target" letter, to see if you've pressed the right key.

POKEing zero into −16384's "partner" location, −16368, changes the value in −16384 to zero automatically. *Letter Getter* does this in lines 40 and 240 to prevent a lingering keypress from being interpreted as deliberate input.

The expression GET K$, used in line 280, pauses the program until a key is pressed, then makes K$ equal the corresponding character.

Atari 400/800, 600/800XL, & 130XE/*Letter Getter*

```
10 OPEN #1,4,0,"K:"
19 REM --"POKE 752,1" TURNS OFF THE CURSOR--
20 POKE 752,1
30 DT=50
40 S=0
50 P=0
60 PRINT CHR$(125)
70 CH=INT(RND(0)*26)+65
80 POSITION INT(RND(0)*38)+1,23
90 PRINT CHR$(CH);
100 I=23
110 IF PEEK(764)<>255 THEN GET #1,P
120 IF P<>CH THEN 200
130 PRINT CHR$(125)
140 S=S+I
150 POSITION 18,0
160 PRINT S
170 FOR DE=1 TO 250
180 NEXT DE
190 GOTO 50
200 FOR DE=1 TO DT
210 NEXT DE
220 PRINT
230 IF I>0 THEN I=I-1:GOTO 110
240 PRINT CHR$(125)
250 PRINT "YOUR SCORE WAS ";S;"."
260 PRINT
270 PRINT "PRESS ANY KEY TO PLAY AGAIN.";
280 GET #1,K
290 GOTO 40
```

The OPEN command in line 10 prepares the program to receive input from the keyboard. The expression GET#1,K in line 280 pauses the program until a key's been pressed, and stores its ASCII code in variable K.

While GET is good for making a program pause, it's not so great for retrieving keystrokes "on the fly" during the main portion of the game. A little programming trickery solves the problem, however. Location 764 contains the value 255 until a key's been pressed, at which point a special "keyboard code" is stored there. Line 110 PEEKs 764 and checks if it's 255. If a keypress is "ready and waiting," the value at 764 isn't 255, and the GET expression swoops down and snatches up the keypress without the usual pause!

Commodore 64 & 128 (C 64 mode)/*Letter Getter*

```
10 DT=150
20 S=0
30 PRINT CHR$(147)
40 CH=INT(RND(1)*26)+65
49 REM --"POKE 214,23" PUTS CURSOR ON LINE 24--
50 POKE 214,23
60 PRINT
70 PRINT TAB(INT(RND(1)*37)+2);CHR$(CH);
80 I=24
90 GET K$
100 IF K$<>CHR$(CH) THEN 170
110 PRINT CHR$(147);
120 S=S+I
130 PRINT TAB(18);S
140 FOR DE=1 TO 250
150 NEXT DE
160 GOTO 30
170 FOR DE=1 TO DT
180 NEXT DE
190 PRINT
200 IF I>0 THEN I=I-1:GOTO 90
210 PRINT CHR$(147);
220 PRINT "YOUR SCORE WAS";S
230 PRINT
240 PRINT "PRESS ANY KEY"
250 PRINT "TO PLAY AGAIN."
260 GET K$
270 IF K$="" THEN 260
280 GOTO 20
```

MODIFICATIONS FOR OTHER COMPUTERS

VIC-20/*Letter Getter*

Change Lines 50, 70, 80, and 130 to read as follows:

```
50 POKE 214,21
70 PRINT TAB(INT(RND(1)*18)+2);CHR$(CH);
80 I=22
130 PRINT TAB(9);S
```

The expression GET K$ in line 90 makes K$ equal the character corresponding to the key most recently pressed (If no key's been pressed, K$ gets the value "", sometimes called the "empty string"). K$'s value is then compared against CHR$(CH) to see if you've pressed the right key.

Lines 260 and 270 pause the program until a key is pressed by using GET to accept and test keyboard input until K$ has a value other than "".

IBM PC & compatibles/*Letter Getter*

This program has been tested and found to work on the following computers and hardware configurations, using the BASICs shown: IBM PC w/Color/Graphics Monitor Adapter, w/Disk BASIC D2.00 or Advanced BASIC A2.00. IBM PCjr w/Cartridge BASIC J1.00. Tandy 1000 w/GW BASIC 2.02 version 00.05.00 or 01.01.00. It should also work on many other PC compatibles.

```
10 WIDTH 40:KEY OFF
20 DT=150
30 S=0
40 CLS
50 CH=INT(RND*26)+65
60 LOCATE 24,INT(RND*38)+2,0
70 PRINT CHR$(CH);
80 I=23
90 K$=INKEY$
100 IF K$<>CHR$(CH) THEN 170
110 CLS
120 S=S+I
130 PRINT TAB(18);S
140 FOR DE=1 TO 250
150 NEXT DE
160 GOTO 40
170 FOR DE=1 TO DT
180 NEXT DE
190 PRINT
200 IF I>0 THEN I=I-1:GOTO 90
210 CLS
220 PRINT "YOUR SCORE WAS";S
230 PRINT
240 PRINT "PRESS ANY KEY TO PLAY AGAIN."
250 K$=INKEY$
260 IF K$="" THEN 250
270 GOTO 30
```

The special expression INKEY$ always equals the character corresponding to the key most recently pressed. If no key has been pressed, INKEY$ has the value "" (sometimes called the "empty string").

The expression K$=INKEY$ in line 90 saves INKEY$'s value in

variable K$. K$ is then tested against CHR$(CH) to see if you've pressed the right key.

Lines 250 and 260 pause the program until a key is pressed by using INKEY$ to accept and test keyboard input until K$ has a value other than "".

Macintosh w/Microsoft BASIC 2.0 or 2.1/*Letter Getter*

```
REM --SELECT EVENLY-SPACED TYPE FONT--
  CALL TEXTFONT(4):CALL TEXTSIZE(9)
  CALL TEXTFACE(64):WIDTH 71
REM --CREATE A FULL-SCREEN WINDOW--
  WINDOW 1,"*LETTER GETTER*",(0,38)-(512,338)
  DT=150
START.GAME:
  S=0
CHOOSE.LETTER:
  CLS
  CH=INT(RND*26)+65
  LOCATE 27,INT(RND*69)+1
  PRINT CHR$(CH);
  I=26
GET.KEYPRESS:
  K$=INKEY$
  IF K$<>CHR$(CH) THEN SCROLL.UP
  CLS
  S=S+I
  LOCATE 1,34
  PRINT S
  FOR DE=1 TO 1500
  NEXT DE
  GOTO CHOOSE.LETTER
SCROLL.UP:
  FOR DE=1 TO DT
  NEXT DE
  PRINT
  IF I>0 THEN I=I-1:GOTO GET.KEYPRESS
  CLS
  PRINT "YOUR SCORE WAS";S
  PRINT
  PRINT "PRESS ANY KEY TO PLAY AGAIN."
WAIT.FOR.KEYPRESS:
  K$=INKEY$
  IF K$="" THEN WAIT.FOR.KEYPRESS ELSE START.GAME
```

The Mac's keyboard is monitored using the expression INKEY$, the same way as the IBM PC's. See IBM PC notes for details.

Tandy Color Computer/*Letter Getter*

```
10 DT=150
20 S=0
30 CLS
40 CH=RND(25)+65
50 PRINT@480+RND(30),CHR$(CH);
60 I=15
70 K$=INKEY$
80 IF K$<>CHR$(CH) THEN 160
100 CLS
110 S=S+I
120 PRINT TAB(14);S
130 FOR DE=1 TO 250
140 NEXT DE
150 GOTO 30
160 FOR DE=1 TO DT
170 NEXT DE
180 PRINT
190 IF I>0 THEN I=I-1:GOTO 70
200 CLS
210 PRINT "YOUR SCORE WAS";S
220 PRINT
230 PRINT "PRESS ANY KEY TO PLAY AGAIN."
240 K$=INKEY$
250 IF K$="" THEN 240
260 GOTO 20
```

The CoCo's keyboard is monitored using the expression INKEY$, the same way as the IBM PC's. See IBM PC notes for details.

Tandy Models III & 4 (Model III mode)/*Letter Getter*

```
10 DT=150
20 S=0
30 CLS
40 CH=RND(25)+65
50 PRINT@480+RND(30),CHR$(CH);
60 I=15
70 K$=INKEY$
80 IF K$<>CHR$(CH) THEN 150
90 CLS
100 S=S+I
110 PRINT TAB(14);S
120 FOR DE=1 TO 250
130 NEXT DE
140 GOTO 30
150 FOR DE=1 TO DT
160 NEXT DE
170 PRINT
180 IF I>0 THEN I=I-1:GOTO 70
190 CLS
200 PRINT "YOUR SCORE WAS";S
210 PRINT
220 PRINT "PRESS ANY KEY TO PLAY AGAIN."
230 K$=INKEY$
240 IF K$="" THEN 230
250 GOTO 20
```

The Model III's keyboard is monitored using the expression INKEY$, the same way as the IBM PC's. See IBM PC notes for details.

TI-99/4A/*Letter Getter*

```
10 DT=150
20 S=0
30 CALL CLEAR
40 CH=INT(RND*26)+65
50 CALL HCHAR(23,INT(RND*22)+1,CH)
60 I=22
70 CALL KEY(3,K,ST)
80 IF K<>CH THEN 150
90 CALL CLEAR
100 S=S+I
110 PRINT TAB(13);S
120 FOR DE=1 TO 100
130 NEXT DE
140 GOTO 30
150 PRINT
160 FOR DE=1 TO DT
170 NEXT DE
180 IF I=0 THEN 210
190 I=I-1
200 GOTO 70
210 CALL CLEAR
220 PRINT "YOUR SCORE WAS";S
230 PRINT
240 PRINT "PRESS ANY KEY TO PLAY AGAIN."
250 CALL KEY(3,K,ST)
260 IF ST<1 THEN 250
270 GOTO 20
```

The expression CALL KEY(3,K,ST) in line 70 sets variables K and ST according to keyboard activity. K is set to equal the ASCII code of the key most recently pressed. ST (short for STatus) will be zero if no key has been pressed; 1 if a new keystroke has been received; or −1 if the same key that was "read" last time is still being held down. K's value is tested against CH to see if you've pressed the right key.

Lines 250 and 260 pause the program until a key is pressed by using CALL KEY(3,K,ST) in a loop that accepts keyboard input and tests ST's value until it equals 1 (meaning a new key has been pressed deliberately).

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```
250 f = 0:lc = max:c = 1:cx = 2:cy = 2
260 pt%(1,0) = 2:pt%(1,1) = 2:mp%(2,2) = 2
270 GOSUB 1000:IF v <> 0 THEN 320
280 r = mp%(cx,cy):mp%(cx-cd(r,1)/2,cy-cd(r,2)/2) = -1
290 mp%(cx,cy) = 0:c = c-1
300 pt%(lc,0) = cx:pt%(lc,1) = cy:lc = lc-1
310 cx = pt%(c,0):cy = pt%(c,1):PRINT "-";:GOTO 270
320 r = rp(RND(1)*v+1)
330 tx = cx+cd(r,1):ty = cy+cd(r,2)
340 IF (r = 1 AND (tx = 2 OR tx = qx)) OR (r = 4 AND (
ty = 2 OR ty = qy)) THEN 320
350 mp%(cx+cd(r,1)/2,cy+cd(r,2)/2) = 5
360 c = c+1:cx = tx:cy = ty:mp%(cx,cy) = r
370 pt%(c,0) = cx:pt%(c,1) = cy:PRINT "+";
380 IF cx <> qx OR cy <> qy THEN 270
390 PRINT:mp%(qx,qy) = 5:IF c = max THEN 520
400 f = 1:w = 4:l = 1
410 PRINT "#";:cx = pt%(l,0):cy = pt%(l,1)
420 IF mp%(cx,cy) = 5 THEN 490
430 GOSUB 1000:IF v = 0 THEN mp%(cx,cy) = 5:GOTO 490
440 r = rp(RND(1)*v+1):c = c+1
450 mp%(cx+cd(r,1)/2,cy+cd(r,2)/2) = 5
460 cx = cx+cd(r,1):cy = cy+cd(r,2)
470 mp%(cx,cy) = r:pt%(c,0) = cx:pt%(c,1) = cy
480 PRINT "@";:GOTO 430
490 l = l+w:IF l < c THEN 410
500 IF c = max THEN 520
510 PRINT:l = 1:w = w-(w = 4)*3:GOTO 410
520 HOME:IF ms = 1 THEN GOSUB 4000:GOTO 870
530 PRINT "Play level 1 is the easiest; 3 is the harde
st."
540 PRINT "At which level do you want to":PRINT "play?
";
550 GOSUB 3000:ls = k-48:IF ls < 1 OR ls > 3 THEN 550
560 HOME:PRINT "Do you want to print a copy of"
570 PRINT "the maze before you begin?"
580 GOSUB 3000:IF k <> 78 AND k <> 89 THEN 580
590 IF k = 89 THEN HOME:GOSUB 4000
600 HOME:lm = INT(15.5-mx/2):cx = 2:cy = 2:sc = 0
610 INVERSE:FOR y = 1 TO my:VTAB y:HTAB lm+1:PRINT sp$
;
620 HTAB lm+mx:PRINT sp$;:NEXT y
630 FOR x = lm+2 TO lm+qx:VTAB 1:HTAB x:PRINT sp$;
640 VTAB my:HTAB x:PRINT sp$;:NEXT x:NORMAL
650 VTAB 2:HTAB lm+1:PRINT "S";
660 VTAB qy:HTAB lm+mx:PRINT "E";:IF ls <> 1 THEN 700
670 INVERSE:FOR y = 2 TO qy:FOR x = 2 TO qx
680 IF mp%(x,y) = -1 THEN VTAB y:HTAB lm+x:PRINT sp$;
690 NEXT x:NEXT y:NORMAL
700 VTAB cy:HTAB lm+cx:PRINT "*";CHR$(8);
710 GOSUB 3000
720 dx = (k = 76)-(k = 74):dy = (k = 75)-(k = 73)
730 IF dx = 0 AND dy = 0 THEN 710
740 tx = cx+dx:ty = cy+dy
750 IF mp%(tx,ty) <> -1 THEN 810
760 PRINT CHR$(7);:IF ls = 1 THEN 710
770 sc = sc+1:VTAB 24:HTAB 11-INT(LEN(STR$(sc))/2)
780 PRINT "Blunders = ";sc;:IF ls = 3 THEN 710
790 IF tx = 1 AND ty = 2 THEN 710
800 INVERSE:VTAB ty:HTAB lm+tx:PRINT sp$;:NORMAL:GOTO
700
810 VTAB cy:HTAB lm+cx:PRINT sp$;
820 cx = tx:cy = ty:IF cx <> qx OR cy <> qy THEN 700
830 VTAB cy:HTAB lm+cx:PRINT "*";
840 FOR l = 1 TO 10:PRINT CHR$(7);:NEXT l
850 VTAB 24:HTAB 31:FOR l = 1 TO 24
860 FOR d = 1 TO 150:NEXT d:PRINT:NEXT l
870 HOME:PRINT "Do you want to generate another";:PRIN
T "maze?";
880 GOSUB 3000:IF k <> 78 AND k <> 89 THEN 880
890 IF k = 89 THEN RUN
900 POKE 16953,95:END
1000 v = 0:FOR z = 1 TO 3:t = rd(mp%(cx,cy),z)
1010 x = cx+cd(t,1):y = cy+cd(t,2)
1020 IF x < 2 OR x > qx OR y < 2 OR y > qy THEN 1040
1030 IF mp%(x,y) < f THEN v = v+1:rp(v) = t
1040 NEXT z:RETURN
2000 PRINT:PRINT "The ";t$;" must be an odd"
2010 PRINT "number between 9 and ";a;"."
2020 PRINT "What ";t$;" do you choose";:INPUT k$
2030 IF k$ = "" THEN 2020
2040 k = INT(VAL(k$)):IF k < 9 OR k > a OR k/2 = INT(k
/2) THEN 2000
2050 RETURN
3000 GET k$:k = ASC(k$):IF k = 3 THEN END
3010 k = k-32*(k > 96)*(k < 123):RETURN
4000 PRINT TAB(4);"Press <RETURN> when your"
4010 PRINT TAB(8);"printer is ready."
4020 GOSUB 3000:IF k <> 13 THEN 4020
4030 HGR2:PRINT
4040 PRINT CHR$(4);"PR# 1":PRINT
4050 FOR y = 1 TO my:FOR x = 1 TO mx
4060 IF y = 2 AND x = 1 THEN PRINT "S";:GOTO 4090
4070 IF y = qy AND x = mx THEN PRINT "E";:GOTO 4090
4080 PRINT CHR$(32+10*(mp%(x,y) = -1));
4090 NEXT x:PRINT:NEXT y:PRINT
4100 PRINT CHR$(4);"PR# 0"
4110 TEXT:PRINT:RETURN
5000 DATA 1,2,4,1,2,3,2,3,4,1,3,4
5010 DATA 0,-2,2,0,0,2,-2,0
```

Note: The program begins by turning off the cursor; it turns it back on again when you answer N *to the question,* DO YOU WANT TO GENERATE ANOTHER MAZE? *If you exit from the program abnormally (e.g., if you have a syntax error or press CONTROL-C), you can turn the cursor back on by typing* POKE 16953,95 *and pressing RETURN.*

OPTION FOR THE ADAM VERSION

If you would like to use a joystick to move around the maze, change lines 710 and 720 to read as follows:

```
710 j = PDL(5):dx = (j = 2)-(j = 8)
720 dy = (j = 4)-(j = 1)
```

Apple II series w/printer/*Maze Creator*

```
10 DIM CD(4,2),RD(4,3),RP(3),XR(2),YR(2):NORMAL
20 MS = 2:SP$ = CHR$(32):FOR I = 1 TO 4
30 FOR J = 1 TO 3:READ RD(I,J):NEXT J,I
40 FOR I = 1 TO 4:FOR J = 1 TO 2:READ CD(I,J):NEXT J,I
50 XR(1) = 59:XR(2) = 39:YR(1) = 59:YR(2) = 23
60 HOME:PRINT TAB(53);"* MAZE CREATOR *":PRINT
70 PRINT " PRESS <D> TO DISPLAY THE MAZE ON YOUR"
80 PRINT TAB(6);"SCREEN OR <P> TO PRINT IT OUT.";
90 GOSUB 3000:MS = (K = 80)+2*(K = 68)
100 ON (MS = 0) GOTO 90:HOME
110 PRINT "THE PROGRAM IS NOW SET TO GENERATE A"
120 PRINT "MAZE OF SIZE ";XR(MS);" X ";YR(MS);" (WIDTH
 X HEIGHT)."
130 PRINT "DO YOU WANT TO CHANGE THE SIZE?"
140 GOSUB 3000:IF K <> 78 AND K <> 89 THEN 140
150 IF K = 78 THEN MX = XR(MS):MY = YR(MS):GOTO 190
160 POKE -16368,0
170 T$ = "WIDTH":A = XR(MS):GOSUB 2000:MX = K
180 T$ = "HEIGHT":A = YR(MS):GOSUB 2000:MY = K
190 QX = MX-1:QY = MY-1:MAX = QX*QY/4
200 HOME:DIM MP%(MX,MY),PT%(MAX,1)
210 PRINT TAB(6);"I'M NOW GENERATING YOUR MAZE."
220 FOR X = 1 TO MX:FOR Y = 1 TO MY
230 MP%(X,Y) = -1:NEXT Y,X
240 F = 0:LC = MAX:C = 1:CX = 2:CY = 2
250 PT%(1,0) = 2:PT%(1,1) = 2:MP%(2,2) = 2
260 GOSUB 1000:IF V <> 0 THEN 310
270 R = MP%(CX,CY):MP%(CX-CD(R,1)/2,CY-CD(R,2)/2) = -1
280 MP%(CX,CY) = 0:C = C-1
290 PT%(LC,0) = CX:PT%(LC,1) = CY:LC = LC-1
300 CX = PT%(C,0):CY = PT%(C,1):PRINT "-";:GOTO 260
310 R = RP(RND(1)*V+1)
320 TX = CX+CD(R,1):TY = CY+CD(R,2)
330 IF (R = 1 AND (TX = 2 OR TX = QX)) OR (R = 4 AND (
TY = 2 OR TY = QY)) THEN 310
340 MP%(CX+CD(R,1)/2,CY+CD(R,2)/2) = 5
```

```
350 C = C+1:CX = TX:CY = TY:MP%(CX,CY) = R
360 PT%(C,0) = CX:PT%(C,1) = CY:PRINT "+";
370 IF CX <> QX OR CY <> QY THEN 260
380 PRINT:MP%(QX,QY) = 5:IF C = MAX THEN 510
390 F = 1:W = 4:L = 1
400 PRINT "#";:CX = PT%(L,0):CY = PT%(L,1)
410 IF MP%(CX,CY) = 5 THEN 480
420 GOSUB 1000:IF V = 0 THEN MP%(CX,CY) = 5:GOTO 480
430 R = RP(RND(1)*V+1):C = C+1
440 MP%(CX+CD(R,1)/2,CY+CD(R,2)/2) = 5
450 CX = CX+CD(R,1):CY = CY+CD(R,2)
460 MP%(CX,CY) = R:PT%(C,0) = CX:PT%(C,1) = CY
470 PRINT "@";:GOTO 420
480 L = L+W:IF L < C THEN 400
490 IF C = MAX THEN 510
500 PRINT:L = 1:W = W-(W = 4)*3:GOTO 400
510 HOME
520 IF MS = 1 THEN GOSUB 4000:GOTO 880
530 PRINT "PLAY LEVEL 1 IS THE EASIEST; 3 IS THE"
540 PRINT "HARDEST."
550 PRINT "AT WHICH LEVEL DO YOU WANT TO PLAY?"
560 GOSUB 3000:LS = K-48:IF LS < 1 OR LS > 3 THEN 560
570 HOME:PRINT "DO YOU WANT TO PRINT A COPY OF THE MAZ
E"
580 PRINT "BEFORE YOU BEGIN?"
590 GOSUB 3000:IF K <> 78 AND K <> 89 THEN 590
600 IF K = 89 THEN HOME:GOSUB 4000
610 HOME:LM = INT(20-MX/2):CX = 2:CY = 2:SC = 0
620 INVERSE:FOR Y = 1 TO MY:VTAB Y:HTAB LM+1:PRINT SP$
;
630 HTAB LM+MX:PRINT SP$;:NEXT Y
640 FOR X = LM+2 TO LM+QX:VTAB 1:HTAB X:PRINT SP$;
650 VTAB MY:HTAB X:PRINT SP$;:NEXT X:NORMAL
660 VTAB 2:HTAB LM+1:PRINT "S";
670 VTAB QY:HTAB LM+MX:PRINT "E";:IF LS <> 1 THEN 710
680 INVERSE:FOR Y = 2 TO QY:FOR X = 2 TO QX
690 IF MP%(X,Y) = -1 THEN VTAB Y:HTAB LM+X:PRINT SP$;
700 NEXT X:NEXT Y:NORMAL
710 VTAB CY:HTAB LM+CX:PRINT "*";
720 GOSUB 3000
730 DX = (K = 76)-(K = 74):DY = (K = 75)-(K = 73)
740 IF DX = 0 AND DY = 0 THEN 720
750 TX = CX+DX:TY = CY+DY
760 IF MP%(TX,TY) <> -1 THEN 820
770 PRINT CHR$(7);:IF LS = 1 THEN 720
780 SC = SC+1:VTAB 24:HTAB 15-INT(LEN(STR$(SC))/2)
790 PRINT "BLUNDERS = ";SC;:IF LS = 3 THEN 720
800 IF TX = 1 AND TY = 2 THEN 720
810 INVERSE:VTAB TY:HTAB LM+TX:PRINT SP$;:NORMAL:GOTO
720
820 VTAB CY:HTAB LM+CX:PRINT SP$;
830 CX = TX:CY = TY:IF CX <> QX OR CY <> QY THEN 710
840 VTAB CY:HTAB LM+CX:PRINT "*";
850 FOR L = 1 TO 10:PRINT CHR$(7);:NEXT L
860 VTAB 24:HTAB 40:FOR L = 1 TO 24
870 FOR D = 1 TO 100:NEXT D:PRINT:NEXT L
880 HOME:PRINT "DO YOU WANT TO GENERATE ANOTHER MAZE?"
890 GOSUB 3000:IF K <> 78 AND K <> 89 THEN 890
900 IF K = 89 THEN RUN
910 POKE -16368,0:END
1000 V = 0:FOR Z = 1 TO 3:T = RD(MP%(CX,CY),Z)
1010 X = CX+CD(T,1):Y = CY+CD(T,2)
1020 IF X < 2 OR X > QX OR Y < 2 OR Y > QY THEN 1040
1030 IF MP%(X,Y) < F THEN V = V+1:RP(V) = T
1040 NEXT Z:RETURN
2000 PRINT:PRINT "THE ";T$;" MUST BE AN ODD NUMBER"
2010 PRINT "BETWEEN 9 AND ";A;"."
2020 PRINT "WHAT ";T$;" DO YOU CHOOSE";:INPUT K$
2030 IF K$ = "" THEN 2020
2040 K = INT(VAL(K$)):IF K < 9 OR K > A OR K/2 = INT(K
/2) THEN 2000
2050 RETURN
3000 POKE -16368,0
3010 K = PEEK(-16384)-128
3030 E = RND(1):IF K < 0 THEN 3010
3040 K = K-32*(K > 96)*(K < 123):RETURN
4000 PRINT TAB(3);"PRESS <RETURN> WHEN YOUR PRINTER IS
"
4010 PRINT TAB(18);"READY."
4020 GOSUB 3000:IF K <> 13 THEN 4020
4040 A$ = "*"
4050 B$ = SP$
4060 E$ = "E"
4070 S$ = "S"
4080 PRINT:PRINT CHR$(4);"PR# 1":PRINT
4100 POKE 35,1:FOR Y = 1 TO MY
4120 FOR X = 1 TO MX
4130 IF Y = 2 AND X = 1 THEN PRINT S$;:GOTO 4170
4140 IF Y = QY AND X = MX THEN PRINT E$;:GOTO 4170
4150 IF MP%(X,Y) = -1 THEN PRINT A$;:GOTO 4170
4160 PRINT B$;
4170 NEXT X:PRINT:NEXT Y:PRINT
4190 PRINT CHR$(4);"PR# 0"
4200 PRINT:POKE 35,24:RETURN
5000 DATA 1,2,4,1,2,3,2,3,4,1,3,4
5010 DATA 0,-2,2,0,0,2,-2,0
```

OPTIONS FOR THE APPLE VERSION

1. If you don't have a printer, omit the program lines printed in red.

2. If you can change the "line pitch" (lines per inch or lpi) of your printer, change it to eight lines per inch in line 4090 and back to normal (usually six lines per inch) in line 4180. For example, if your printer manual says the command sequence for eight lpi is ESCAPE 1 and the sequence for six lpi is ESCAPE 2, you'd add the following lines to the program:

```
4090 PRINT CHR$(27);"1"
4180 PRINT CHR$(27);"2"
```

(Note that CHR$(27) is the equivalent of ESCAPE.)

3. If you have a 40-column printer, change line 50 to read as follows:

```
50 XR(1) = 39:XR(2) = 39:YR(1) = 59:YR(2) = 23
```

4. If your printer has Epson-compatible graphics capability, change lines 4040–4070 to read as follows:

```
4040 A$ = CHR$(255):FOR X = 2 TO 6:A$ = A$+CHR$(255):N
EXT X
4050 B$ = CHR$(0):FOR X = 2 TO 6:B$ = B$+CHR$(0):NEXT
X
4060 E$ = CHR$(0)+CHR$(62)+CHR$(42)+CHR$(42)+CHR$(42)+
CHR$(34)
4070 S$ = CHR$(52)+CHR$(82)+CHR$(74)+CHR$(74)+CHR$(36)
+CHR$(0)
```

Also, add lines 4030, 4090, 4110, and 4180:

```
4030 MB = 6*MX:LB = INT(MB/256):FB = MB-LB*256
4090 PRINT CHR$(27);"1"
4110 PRINT CHR$(27);"K";CHR$(FB);CHR$(LB);
4180 PRINT CHR$(27);"2"
```

5. If you would like to use a joystick to move around the maze, change lines 720–740 to read as follows:

```
720 DY = (PDL(1) > 192)-(PDL(1) < 64)
730 DX = (PDL(0) > 192)-(PDL(0) < 64)
740 IF (DX = 0)+(DY = 0) <> 1 THEN 720
```

Atari w/48K RAM & printer/*Maze Creator*

```
10 DIM A$(6),B$(6),BK$(1),E$(6),K$(2),L$(300),S$(6),SP
$(1),T$(6)
20 DIM CD(4,2),RD(4,3),RP(3),XR(2),YR(2)
30 POKE 82,0:POKE 752,1
40 MS=2:BK$=CHR$(160):SP$=CHR$(32):FOR I=1 TO 4
50 FOR J=1 TO 3:READ T:RD(I,J)=T:NEXT J:NEXT I
60 FOR I=1 TO 4:FOR J=1 TO 2
70 READ T:CD(I,J)=T:NEXT J:NEXT I
80 XR(1)=49:XR(2)=39:YR(1)=49:YR(2)=23
90 PRINT CHR$(125):POKE 85,12
100 PRINT "* MAZE CREATOR *":PRINT
110 PRINT " PRESS <D> TO DISPLAY THE MAZE ON YOUR"
120 POKE 85,5:PRINT "SCREEN OR <P> TO PRINT IT OUT.";
```

```
130 GOSUB 3000:MS=(K=80)+2*(K=68)
140 ON (MS=0) GOTO 130:PRINT CHR$(125);
150 PRINT "THE PROGRAM IS NOW SET TO GENERATE A"
160 PRINT "MAZE OF SIZE ";XR(MS);" X ";YR(MS);" (WIDTH
 X HEIGHT)."
170 PRINT "DO YOU WANT TO CHANGE THE SIZE?"
180 GOSUB 3000:IF K<>78 AND K<>89 THEN 180
190 IF K=78 THEN MX=XR(MS):MY=YR(MS):GOTO 230
200 POKE 764,255
210 T$="WIDTH":H=XR(MS):GOSUB 2000:MX=K
220 T$="HEIGHT":H=YR(MS):GOSUB 2000:MY=K
230 QX=MX-1:QY=MY-1:MAX=QX*QY/4
240 PRINT CHR$(125);:DIM MP(MX,MY),PT(MAX,1)
250 POKE 85,7:PRINT "I'M GENERATING YOUR MAZE."
260 FOR X=1 TO MX:FOR Y=1 TO MY
270 MP(X,Y)=-1:NEXT Y:NEXT X
280 F=0:LC=MAX:C=1:CX=2:CY=2
290 PT(1,0)=2:PT(1,1)=2:MP(2,2)=2
300 GOSUB 1000:IF V<>0 THEN 350
310 R=MP(CX,CY):MP(CX-CD(R,1)/2,CY-CD(R,2)/2)=-1
320 MP(CX,CY)=0:C=C-1
330 PT(LC,0)=CX:PT(LC,1)=CY:LC=LC-1
340 CX=PT(C,0):CY=PT(C,1):PRINT "-";:GOTO 300
350 R=RP(INT(RND(1)*V+1))
360 TX=CX+CD(R,1):TY=CY+CD(R,2)
370 IF (R=1 AND (TX=2 OR TX=QX)) OR (R=4 AND (TY=2 OR
TY=QY)) THEN 350
380 MP(CX+CD(R,1)/2,CY+CD(R,2)/2)=5
390 C=C+1:CX=TX:CY=TY:MP(CX,CY)=R
400 PT(C,0)=CX:PT(C,1)=CY:PRINT "+";
410 IF CX<>QX OR CY<>QY THEN 300
420 PRINT :MP(QX,QY)=5:IF C=MAX THEN 550
430 F=1:W=4:L=1
440 PRINT "#";:CX=PT(L,0):CY=PT(L,1)
450 IF MP(CX,CY)=5 THEN 520
460 GOSUB 1000:IF V=0 THEN MP(CX,CY)=5:GOTO 520
470 R=RP(INT(RND(1)*V+1)):C=C+1
480 MP(CX+CD(R,1)/2,CY+CD(R,2)/2)=5
490 CX=CX+CD(R,1):CY=CY+CD(R,2)
500 MP(CX,CY)=R:PT(C,0)=CX:PT(C,1)=CY
510 PRINT "@";:GOTO 460
520 L=L+W:IF L<C THEN 440
530 IF C=MAX THEN 550
540 PRINT :L=1:W=W-(W=4)*3:GOTO 440
550 PRINT CHR$(125);
560 IF MS=1 THEN GOSUB 4000:GOTO 940
570 PRINT "PLAY LEVEL 1 IS THE EASIEST; 3 IS THE"
580 PRINT "HARDEST."
590 PRINT "AT WHICH LEVEL DO YOU WANT TO PLAY?"
600 GOSUB 3000:LS=K-48:IF LS<1 OR LS>3 THEN 600
610 PRINT CHR$(125);"DO YOU WANT TO PRINT A COPY OF TH
E MAZE"
620 POKE 85,11:PRINT "BEFORE YOU BEGIN?"
630 GOSUB 3000:IF K<>78 AND K<>89 THEN 630
640 IF K=89 THEN PRINT CHR$(125);:GOSUB 4000
650 PRINT CHR$(125);:LM=INT(20-MX/2):CX=2:CY=2:SC=0
660 FOR Y=1 TO MY:POSITION LM,Y-1:PRINT BK$;
670 POKE 85,LM+QX:PRINT BK$;:NEXT Y
680 FOR X=LM+1 TO LM+QX-1:POSITION X,0:PRINT BK$;
690 POSITION X,QY:PRINT BK$;:NEXT X
700 POSITION LM,1:PRINT "S";
710 POSITION LM+QX,QY-1:PRINT "E";:IF LS<>1 THEN 750
720 FOR Y=2 TO QY:POSITION LM+1,Y-1
730 FOR X=2 TO QX:PRINT CHR$(32+(MP(X,Y)=-1)*128);
740 NEXT X:NEXT Y
750 POSITION LM+CX-1,CY-1:PRINT "*";
760 GOSUB 3000
770 DX=(K=76)-(K=74):DY=(K=75)-(K=73)
780 IF DX=0 AND DY=0 THEN 760
790 TX=CX+DX:TY=CY+DY
800 IF MP(TX,TY)<>-1 THEN 870
810 SOUND 0,100,10,10:FOR D=1 TO 25:NEXT D
820 SOUND 0,0,0,0:IF LS=1 THEN 760
830 SC=SC+1:HL=15-LEN(STR$(SC))
840 POSITION HL,23:PRINT "BLUNDERS = ";SC;
850 IF LS=3 THEN 760
860 POSITION LM+TX-1,TY-1:PRINT BK$;:GOTO 760
870 POSITION LM+CX-1,CY-1:PRINT SP$;
880 CX=TX:CY=TY:POSITION LM+CX-1,CY-1:PRINT "*";
890 IF CX<>QX OR CY<>QY THEN 750
900 FOR L=1 TO 10:SOUND 0,100,10,10
910 FOR D=1 TO 25:NEXT D:SOUND 0,0,0,0:NEXT L
920 POSITION 39,23:FOR L=1 TO 24:PRINT
930 FOR D=1 TO 30:NEXT D:NEXT L
940 PRINT CHR$(125);"DO YOU WANT TO GENERATE ANOTHER M
AZE?"
950 GOSUB 3000:IF K<>78 AND K<>89 THEN 950
960 IF K=89 THEN RUN
970 POKE 82,2:POKE 752,0:END
1000 V=0:FOR Z=1 TO 3:T=RD(MP(CX,CY),Z)
1010 X=CX+CD(T,1):Y=CY+CD(T,2)
1020 IF X<2 OR X>QX OR Y<2 OR Y>QY THEN 1040
1030 IF MP(X,Y)<F THEN V=V+1:RP(V)=T
1040 NEXT Z:RETURN
2000 TRAP 2000
2010 PRINT :PRINT "THE ";T$;" MUST BE AN ODD NUMBER"
2020 PRINT "BETWEEN 9 AND ";H;"."
2030 PRINT "WHAT ";T$;" DO YOU CHOOSE";:INPUT K$
2040 IF K$="" THEN 2030
2050 K=INT(VAL(K$)):IF K<9 OR K>H OR K/2=INT(K/2) THEN
 2010
2060 TRAP 40000:RETURN
3000 POKE 764,255:OPEN #1,4,0,"K:"
3010 GET #1,K:CLOSE #1
3020 K=K-32*(K>96)*(K<123):RETURN
4000 PRINT "  PRESS <RETURN> WHEN YOUR PRINTER IS"
4010 POKE 85,17:PRINT "READY."
4020 GOSUB 3000:IF K<>155 THEN 4020
4040 A$="*"
4050 B$=SP$
4060 S$="S"
4070 E$="E"
4080 PRINT :OPEN #2,8,0,"P:"
4100 FOR Y=1 TO MY:L$=""
4120 FOR X=1 TO MX
4130 IF Y=2 AND X=1 THEN L$(LEN(L$)+1)=S$:GOTO 4170
4140 IF Y=MY-1 AND X=MX THEN L$(LEN(L$)+1)=E$:GOTO 417
0
4150 IF MP(X,Y)=-1 THEN L$(LEN(L$)+1)=A$:GOTO 4170
4160 L$(LEN(L$)+1)=B$
4170 NEXT X:PRINT #2;L$:NEXT Y:PRINT #2
4190 PRINT #2:CLOSE #2:RETURN
5000 DATA 1,2,4,1,2,3,2,3,4,1,3,4
5010 DATA 0,-2,2,0,0,2,-2,0
```

OPTIONS FOR THE ATARI VERSION

1. If you don't have a printer, omit the program lines printed in red.

2. If you can change the "line pitch" (lines per inch or lpi) of your printer, change it to eight lines per inch in line 4090 and back to normal (usually six lines per inch) in line 4180. For example, if your printer manual says the command sequence for eight lpi is ESCAPE 1 and the sequence for six lpi is ESCAPE 2, you'd add the following lines to the program:

```
4090 PRINT #2;CHR$(27);"1"
4180 PRINT #2;CHR$(27);"2"
```

(Note that CHR$(27) is the equivalent of ESCAPE.)

3. If you have a 40-column printer, change line 80 to read as follows:

```
80 XR(1)=39:XR(2)=39:YR(1)=49:YR(2)=23
```

4. If your printer has Epson-compatible graphics capability, change lines 4040–4070 to read as follows:

```
4040 A$=CHR$(255):A$(6)=CHR$(255):A$(2)=A$
4050 B$=CHR$(0):B$(6)=CHR$(0):B$(2)=B$
4060 E$(1)=CHR$(0):E$(2)=CHR$(62):E$(3)=CHR$(42):E$(4)
=CHR$(42):E$(5)=CHR$(42):E$(6)=CHR$(34)
4070 S$(1)=CHR$(52):S$(2)=CHR$(82):S$(3)=CHR$(74):S$(4
)=CHR$(74):S$(5)=CHR$(36):S$(6)=CHR$(0)
```

Also, add lines 4030, 4090, 4110, and 4180:

```
390 PRINT:MP(QX,QY)=5:IF C=MAX THEN 510
400 F=1:W=4:L=1
410 PRINT "#";:CX=PT(L,0):CY=PT(L,1)
420 IF MP(CX,CY)=5 THEN 490
430 GOSUB 1000:IF V=0 THEN MP(CX,CY)=5:GOTO 490
440 R=RP(INT(RND*V)+1):C=C+1
450 MP(CX+CD(R,1)/2,CY+CD(R,2)/2)=5
460 CX=CX+CD(R,1):CY=CY+CD(R,2)
470 MP(CX,CY)=R:PT(C,0)=CX:PT(C,1)=CY
480 PRINT "@";:GOTO 430
490 L=L+W:IF L<C THEN 410 ELSE IF C=MAX THEN 510
500 PRINT:L=1:W=W+(W=4)*3:GOTO 410
510 CLS
520 IF MS=1 THEN GOSUB 4000:GOTO 880
530 PRINT "Play level 1 is the easiest; 3 is the"
540 PRINT "hardest."
550 PRINT "At which level do you want to play?"
560 GOSUB 3000:LS=K-48:IF LS<1 OR LS>3 THEN 560
570 CLS:PRINT "Do you want to print a copy of the maze
"
580 PRINT "before you begin?"
590 GOSUB 3000:IF K<>78 AND K<>89 THEN 590
600 IF K=89 THEN CLS:GOSUB 4000
610 CLS:LM=INT((SW-MX)/2):CX=2:CY=2:SC=0
620 LOCATE 1,LM+1:PRINT STRING$(MX,219)
630 LOCATE MY,LM+1:PRINT STRING$(MX,219)
640 FOR Y=2 TO QY:LOCATE Y,LM+1
650 PRINT CHR$(219);SPC(QX-1);CHR$(219);:NEXT Y
660 LOCATE 2,LM+1:PRINT "S";
670 LOCATE MY-1,LM+MX:PRINT "E";:IF LS<>1 THEN 710
680 FOR Y=2 TO QY:LOCATE Y,LM+2
690 FOR X=2 TO QX:PRINT CHR$(32-187*(MP(X,Y)=-1));
700 NEXT X,Y
710 LOCATE CY,LM+CX:PRINT "*";
720 GOSUB 3000
730 DX=(K=74)-(K=76):DY=(K=73)-(K=75)
740 IF DX=0 AND DY=0 THEN 720
750 TX=CX+DX:TY=CY+DY
760 IF MP(TX,TY)<>-1 THEN 820
770 SOUND 100,2:IF LS=1 THEN 720
780 SC=SC+1:HL=LEN(STR$(SC)):LOCATE 24,INT((SW-HL)/2)-
4
790 PRINT "Blunders =";SC;:IF LS=3 THEN 720
800 IF TX=1 AND TY=2 THEN 720
810 LOCATE TY,LM+TX:PRINT CHR$(219);:GOTO 720
820 LOCATE CY,LM+CX:PRINT SP$;
830 CX=TX:CY=TY:IF CX<>QX OR CY<>QY THEN 710
840 LOCATE CY,LM+CX:PRINT "*";
850 FOR L=1 TO 10:SOUND 100,2:FOR D=1 TO 20
860 NEXT D,L:LOCATE 24,SW-1:FOR L=1 TO 24
870 FOR D=1 TO 100:NEXT D:PRINT:NEXT L
880 CLS:PRINT "Do you want to generate another maze?"
890 GOSUB 3000:IF K<>78 AND K<>89 THEN 890
900 IF K=89 THEN RUN ELSE END
1000 V=0:FOR Z=1 TO 3:T=RD(MP(CX,CY),Z)
1010 X=CX+CD(T,1):Y=CY+CD(T,2)
1020 IF X<2 OR X>QX OR Y<2 OR Y>QY THEN 1040
1030 IF MP(X,Y)<F THEN V=V+1:RP(V)=T
1040 NEXT Z:RETURN
2000 PRINT:PRINT "The ";T$;" must be an odd number"
2010 PRINT "between 9 and";STR$(H);"."
2020 PRINT "What ";T$;" do you choose";:INPUT K$
2030 IF K$="" THEN 2020 ELSE K=VAL(K$)
2040 IF K<9 OR K>H OR (K MOD 2)=0 THEN 2000
2050 RETURN
3000 POKE 1050,PEEK(1052)
3010 K$=INKEY$:IF K$="" THEN E=RND:GOTO 3010
3020 K=ASC(K$):K=K-32*(K>96)*(K<123):RETURN
4000 PRINT TAB(3);"Press <ENTER> when your printer is"
4010 PRINT TAB(17);"ready."
4020 GOSUB 3000:IF K<>13 THEN 4020 ELSE PRINT
4040 A$="*"
4050 B$=SP$
4060 E$="E"
4070 S$="S"
4090 FOR Y=1 TO MY
4110 FOR X=1 TO MX
4120 IF Y=2 AND X=1 THEN LPRINT S$;:GOTO 4150
4130 IF Y=QY AND X=MX THEN LPRINT E$;:GOTO 4150
4140 IF MP(X,Y)=-1 THEN LPRINT A$; ELSE LPRINT B$;
4150 NEXT X:LPRINT:NEXT Y:LPRINT
4170 PRINT:RETURN
5000 DATA 1,2,4,1,2,3,2,3,4,1,3,4
5010 DATA 0,-2,2,0,0,2,-2,0
```

OPTIONS FOR THE IBM PC & COMPATIBLES VERSION

1. If your system can display 80 columns, change lines 20 and 80 to read as follows:

```
20 SW=80
80 XR(1)=59:XR(2)=69:YR(1)=59:YR(2)=23
```

This 80-column option has been tested and found to work on the following computers and hardware configurations, using the BASICs shown: IBM PC w/Color/Graphics Monitor Adapter or Monochrome/Printer Card, w/Disk BASIC D2.00 or Advanced BASIC A2.00. IBM PCjr w/128K RAM, w/Cartridge BASIC J1.00. Tandy 1000 w/GW-BASIC version 00.05.00 or 01.01.00.

2. If you don't have a printer, omit the program lines printed in red.

3. If you can change the "line pitch" (lines per inch or lpi) of your printer, change it to eight lines per inch in line 4080 and back to normal (usually six lines per inch) in line 4160. For example, if your printer manual says the command sequence for eight lpi is ESCAPE 1 and the sequence for six lpi is ESCAPE 2, you'd add the following lines to the program:

```
4080 LPRINT CHR$(27);"1"
4160 LPRINT CHR$(27);"2"
```

(Note that CHR$(27) is the equivalent of ESCAPE.)

4. If you have a 40-column printer, change line 80 to read as follows:

```
80 XR(1)=39:XR(2)=39:YR(1)=59:YR(2)=23
```

5. If your printer has Epson-compatible graphics capability, change lines 4040–4070 to read as follows:

```
4040 A$=STRING$(6,255)
4050 B$=STRING$(6,0)
4060 E$=CHR$(0)+CHR$(62)+STRING$(3,42)+CHR$(34)
4070 S$=CHR$(52)+CHR$(82)+STRING$(2,74)+CHR$(36)+CHR$(
0)
```

Also, add lines 4030, 4080, 4100, and 4160:

```
4030 WIDTH "LPT1:",255:MB=6*MX:LB=MB/256:FB=MB-LB*256
4080 LPRINT CHR$(27);"1"
4100 LPRINT CHR$(27);"K";CHR$(FB);CHR$(LB);
4160 LPRINT CHR$(27);"2"
```

6. If you would like to use a joystick to move around the maze, change lines 720–740 to read as follows:

```
720 J0=STICK(0):J1=STICK(1)
730 DX=(J0<24)-(J0>72):DY=(J1<24)-(J1>72)
740 IF (DX=0)+(DY=0)<>-1 THEN 720
```

Also, add line 30:

```
30 STRIG ON
```

Macintosh w/printer & Microsoft BASIC 2.0 or 2.1/ *Maze Creator*

```
    CALL TEXTFONT(4):CALL TEXTSIZE(9)
    CALL TEXTFACE(64):CALL TEXTMODE(2)
    WIDTH 71:WINDOW 1,,(0,38)-(512,338)
    DEFINT A-Z:RANDOMIZE TIMER
    DIM CD(4,2),RD(4,3),RP(3),XR(2),YR(2)
    FOR I=1 TO 4:FOR J=1 TO 3:READ RD(I,J):NEXT J,I
    FOR I=1 TO 4:FOR J=1 TO 2:READ CD(I,J):NEXT J,I
    MS=2:XR(1)=59:XR(2)=59:YR(1)=59:YR(2)=25
    CLS:PRINT TAB(25);"* MAZE CREATOR *":PRINT
    PRINT " Press <D> to display the maze on your ";
    PRINT "screen or <P> to print it out."
  WAIT.FOR.D.OR.P.KEY:
    GOSUB KEYPRESS:MS=-(K=80)-2*(K=68)
    IF MS=0 THEN WAIT.FOR.D.OR.P.KEY ELSE CLS
    PRINT "The program is now set to generate a maze";
```

→

```
    PRINT " of size";XR(MS);"x";YR(MS);"(width x"
    PRINT "height).  Do you want to change the size?";
  CHANGE.SIZE:
    GOSUB KEYPRESS
    IF K<>78 AND K<>89 THEN CHANGE.SIZE
    IF K=78 THEN MX=XR(MS):MY=YR(MS):GOTO SET.UP.MAZE
    PRINT " Y":T$="width":H=XR(MS)
    GOSUB FIND.DIMENSIONS:MX=K
    T$="height":H=YR(MS)
    GOSUB FIND.DIMENSIONS:MY=K
  SET.UP.MAZE:
    QX=MX-1:QY=MY-1:MAX=QX*QY/4
    CLS:DIM MP(MX,MY),PT(MAX,1)
    PRINT TAB(21);"I'm now generating your maze."
    PRINT
    FOR X=1 TO MX:FOR Y=1 TO MY:MP(X,Y)=-1:NEXT Y,X
    F=0:LC=MAX:C=1:CX=2:CY=2
    PT(1,0)=2:PT(1,1)=2:MP(2,2)=2
  GENERATE.PASSAGE:
    GOSUB FIND.DIRECTION:IF V<>0 THEN SET.DIRECTION
    R=MP(CX,CY):MP(CX-CD(R,1)/2,CY-CD(R,2)/2)=-1
    MP(CX,CY)=0:C=C-1
    PT(LC,0)=CX:PT(LC,1)=CY:LC=LC-1
    CX=PT(C,0):CY=PT(C,1)
    PRINT "-";:GOTO GENERATE.PASSAGE
  SET.DIRECTION:
    R=RP(INT(RND*V)+1):TX=CX+CD(R,1):TY=CY+CD(R,2)
    IF (R=1 AND (TX=2 OR TX=QX)) OR (R=4 AND (TY=2 OR
TY=QY)) THEN SET.DIRECTION
    MP(CX+CD(R,1)/2,CY+CD(R,2)/2)=5
    C=C+1:CX=TX:CY=TY:MP(CX,CY)=R
    PT(C,0)=CX:PT(C,1)=CY:PRINT "+";
    IF CX<>QX OR CY<>QY THEN GENERATE.PASSAGE
    PRINT:MP(QX,QY)=5:IF C=MAX THEN DISPLAY.OR.PRINT
    F=1:W=4:L=1
  CHECK.NEW.LOCATION:
    PRINT "#";:CX=PT(L,0):CY=PT(L,1)
    IF MP(CX,CY)=5 THEN MORE.DEADENDS
  GENERATE.DEADEND:
    GOSUB FIND.DIRECTION
    IF V=0 THEN MP(CX,CY)=5:GOTO MORE.DEADENDS
    R=RP(INT(RND*V)+1):C=C+1
    MP(CX+CD(R,1)/2,CY+CD(R,2)/2)=5
    CX=CX+CD(R,1):CY=CY+CD(R,2)
    MP(CX,CY)=R:PT(C,0)=CX:PT(C,1)=CY
    PRINT "@";:GOTO GENERATE.DEADEND
  MORE.DEADENDS:
    L=L+W:IF L<C THEN CHECK.NEW.LOCATION
    IF C=MAX THEN DISPLAY.OR.PRINT
    L=1:W=W+(W=4)*3:GOTO CHECK.NEW.LOCATION
  DISPLAY.OR.PRINT:
    CLS
    IF MS=1 THEN GOSUB PRINT.MAZE:GOTO NEW.MAZE
    PRINT TAB(12);"Play level 1 is the easiest; ";
    PRINT "3 is the hardest.":PRINT TAB(18);
    PRINT "At which level do you want to play?"
  SET.LEVEL:
    GOSUB KEYPRESS:LS=K-48
    IF LS<1 OR LS>3 THEN SET.LEVEL
    CLS:PRINT TAB(7);"Do you want to print a copy ";
    PRINT "of the maze before you begin?"
    GOSUB GET.Y.OR.N:IF K=89 THEN CLS:GOSUB PRINT.MAZE
    CLS:PRINT TAB(11);"Press <M> if you want to ";
    PRINT "play using the mouse or"
    PRINT TAB(17);"<K> to use the keyboard.";
  WAIT.FOR.K.OR.M.KEY:
    GOSUB KEYPRESS
    IF K<>75 AND K<>77 THEN WAIT.FOR.K.OR.M.KEY
    USING.MOUSE=(K=77)
    CLS:LM=35-MX/2:CX=2:CY=2:SC=0
    LINE (7*LM,0)-(7*(LM+MX),11),33,BF
    LINE (7*LM,11*(MY-1))-(7*(LM+MX),11*MY),33,BF
    LINE (7*LM,11)-(7*(LM+1),11*QY),33,BF
    LINE (7*(LM+MX-1),11)-(7*(LM+MX),11*QY),33,BF
    LOCATE 2,LM+1:PRINT "S";
    LOCATE QY,LM+MX:PRINT "E";
    IF LS<>1 THEN PRINT.POSITION
    FOR Y=2 TO QY:FOR X=2 TO QX
    IF MP(X,Y)=-1 THEN GOSUB DRAW.BOX
    NEXT X:NEXT Y
  PRINT.POSITION:
    LOCATE CY,LM+CX:PRINT "*";
  WAIT.FOR.INPUT:
    IF USING.MOUSE THEN HANDLE.MOUSE
  WAIT.FOR.I.J.K.L:
    GOSUB KEYPRESS
    DX=(K=74)-(K=76):DY=(K=73)-(K=75)
    IF DX=0 AND DY=0 THEN WAIT.FOR.I.J.K.L
    GOTO TEST.PROSPECTIVE.MOVE
  HANDLE.MOUSE:
    DRAG=0
  READ.MOUSE:
    DM=MOUSE(0)
    MOUSE.X=MOUSE(1)/7-LM+1:MOUSE.Y=MOUSE(2)/11+1
    IF CX<>MOUSE.X OR CY<>MOUSE.Y THEN NOT.OVER.STAR
    IF NOT DRAG THEN DRAG=-1
    GOTO READ.MOUSE
  NOT.OVER.STAR:
    IF NOT DRAG THEN GOTO READ.MOUSE
    DX=SGN(MOUSE.X-CX):DY=SGN(MOUSE.Y-CY)
  TEST.PROSPECTIVE.MOVE:
    TX=CX+DX:TY=CY+DY
    IF MP(TX,TY)<>-1 THEN ERASE.POSITION
    SOUND 100,2:IF LS=1 THEN WAIT.FOR.INPUT
    SC=SC+1:LOCATE 27,32-LEN(STR$(SC))\2
    TEXTMODE(0):PRINT "Blunders:";SC;:TEXTMODE(2)
    IF LS=3 OR TX=1 AND TY=2 THEN WAIT.FOR.INPUT
    Y=TY:X=TX:GOSUB DRAW.BOX
    GOTO WAIT.FOR.INPUT
  ERASE.POSITION:
    LOCATE CY,LM+CX:PRINT "*";
    CX=TX:CY=TY
    LOCATE CY,LM+CX:PRINT "*";
    IF CX<>QX OR CY<>QY THEN WAIT.FOR.INPUT
    FOR L=1 TO 10:SOUND 100,2:SOUND 100,2,0
    NEXT L:LOCATE 27,70:FOR L=1 TO 27
    FOR D=1 TO 100:NEXT D:PRINT:NEXT L
  NEW.MAZE:
    CLS:PRINT TAB(17);"Do you want to generate ";
    PRINT "another maze?"
  WAIT.FOR.ANOTHER:
    GOSUB KEYPRESS
    IF K<>78 AND K<>89 THEN WAIT.FOR.ANOTHER
    IF K=89 THEN RUN ELSE END
  KEYPRESS:
    KY$=INKEY$:IF KY$="" THEN KEYPRESS
    K=ASC(KY$):K=K-32*(K>96)*(K<123):RETURN
  FIND.DIMENSIONS:
    PRINT:PRINT "The ";T$;" must be an odd number ";
    PRINT "between 9 and";STR$(H);"."
  PRINT.CHOOSE:
    PRINT "What ";T$;" do you choose";:INPUT K$
    IF K$="" THEN PRINT.CHOOSE ELSE K=VAL(K$)
    IF K<9 OR K>H OR K MOD 2 = 0 THEN FIND.DIMENSIONS
    RETURN
  FIND.DIRECTION:
    V=0:FOR Z=1 TO 3:T=RD(MP(CX,CY),Z)
    X=CX+CD(T,1):Y=CY+CD(T,2)
    IF X<2 OR X>QX OR Y<2 OR Y>QY THEN NEW.DIRECTION
    IF MP(X,Y)<F THEN V=V+1:RP(V)=T
  NEW.DIRECTION:
    NEXT Z:RETURN
  PRINT.MAZE:
    PRINT TAB(20);"Is your printer an Imagewriter?"
    GOSUB GET.Y.OR.N:IMAGEWRITER=(K=89):CLS
    PRINT TAB(17);
    PRINT "Press <RETURN> when your printer is ready."
  WAIT.FOR.RETURN:
    GOSUB KEYPRESS:IF K<>13 THEN WAIT.FOR.RETURN
    LPRINT:IF NOT IMAGEWRITER THEN A$="*":GOTO READY
    WIDTH LPRINT 255
    E$=CHR$(27):A$=E$+CHR$(39)+"*"+E$+"$"
    LPRINT E$;"N":LPRINT E$;"T16"
```

```
    LPRINT E$;"-";E$;"I*H";STRING$(8,255);CHR$(4)
  READY:
    FOR Y=1 TO MY:FOR X=1 TO MX
    IF Y=2 AND X=1 THEN LPRINT "S";:GOTO ADVANCE
    IF Y=QY AND X=MX THEN LPRINT "E";:GOTO ADVANCE
    IF MP(X,Y)=-1 THEN LPRINT A$; ELSE LPRINT " ";
  ADVANCE:
    NEXT X:LPRINT:NEXT Y:LPRINT
    IF IMAGEWRITER THEN LPRINT E$;"A":WIDTH LPRINT 80
    PRINT:RETURN
  GET.Y.OR.N:
    GOSUB KEYPRESS
    IF K<>78 AND K<>89 THEN GET.Y.OR.N
    RETURN
  DRAW.BOX:
    NX=7*(LM+X-1):NY=11*(Y-1)
    LINE (NX,NY)-(NX+7,NY+11),33,BF:RETURN
  REM DATA FOR RD AND CD ARRAYS
    DATA 1,2,4,1,2,3,2,3,4,1,3,4
    DATA 0,-2,2,0,0,2,-2,0
```

OPTION FOR THE MACINTOSH VERSION

If you don't have a printer, omit the program lines printed in red.

Tandy Color Computer w/64K RAM & printer/
Maze Creator

```
10 CLEAR 300
20 DIM CD(4,2),RD(4,3),RP(3),XR(2),YR(2)
30 MS=2:BK$=CHR$(191):SP$=CHR$(32):FOR I=1 TO 4
40 FOR J=1 TO 3:READ RD(I,J):NEXT J,I
50 FOR I=1 TO 4:FOR J=1 TO 2:READ CD(I,J):NEXT J,I
60 XR(1)=47:XR(2)=31:YR(1)=47:YR(2)=15
70 CLS:PRINT TAB(8);"* MAZE CREATOR *":PRINT
80 PRINT " PRESS <D> TO DISPLAY THE MAZE"
90 PRINT " ON YOUR SCREEN OR <P> TO PRINT"
100 PRINT TAB(12);"IT OUT.";
110 GOSUB 3000:MS=-(K=80)-2*(K=68)
120 IF MS=0 THEN 110 ELSE CLS
130 PRINT "THE PROGRAM IS NOW SET TO"
140 PRINT "GENERATE A MAZE OF SIZE";XR(MS);"X";YR(MS);
150 PRINT "(WIDTH X HEIGHT)."
160 PRINT "DO YOU WANT TO CHANGE THE SIZE?"
170 GOSUB 3000:IF K<>78 AND K<>89 THEN 170
180 IF K=78 THEN MX=XR(MS):MY=YR(MS):GOTO 210
190 K$="":T$="WIDTH":H=XR(MS):GOSUB 2000:MX=K
200 K$="":T$="HEIGHT":H=YR(MS):GOSUB 2000:MY=K
210 QX=MX-1:QY=MY-1:MAX=QX*QY/4
220 CLS:DIM MP(MX,MY),PT(MAX,1)
230 PRINT " I'M NOW GENERATING YOUR MAZE."
240 FOR X=1 TO MX:FOR Y=1 TO MY:MP(X,Y)=-1:NEXT Y,X
250 F=0:LC=MAX:C=1:CX=2:CY=2
260 PT(1,0)=2:PT(1,1)=2:MP(2,2)=2
270 GOSUB 1000:IF V<>0 THEN 320
280 R=MP(CX,CY):MP(CX-CD(R,1)/2,CY-CD(R,2)/2)=-1
290 MP(CX,CY)=0:C=C-1
300 PT(LC,0)=CX:PT(LC,1)=CY:LC=LC-1
310 CX=PT(C,0):CY=PT(C,1):PRINT "-";:GOTO 270
320 R=RP(RND(V)):TX=CX+CD(R,1):TY=CY+CD(R,2)
330 IF (R=1 AND (TX=2 OR TX=QX)) OR (R=4 AND (TY=2 OR
TY=QY)) THEN 320
340 MP(CX+CD(R,1)/2,CY+CD(R,2)/2)=5
350 C=C+1:CX=TX:CY=TY:MP(CX,CY)=R
360 PT(C,0)=CX:PT(C,1)=CY:PRINT "+";
370 IF CX<>QX OR CY<>QY THEN 270
380 PRINT:MP(QX,QY)=5:IF C=MAX THEN 500
390 F=1:W=4:L=1
400 PRINT "#";:CX=PT(L,0):CY=PT(L,1)
410 IF MP(CX,CY)=5 THEN 480
420 GOSUB 1000:IF V=0 THEN MP(CX,CY)=5:GOTO 480
430 R=RP(RND(V)):C=C+1
440 MP(CX+CD(R,1)/2,CY+CD(R,2)/2)=5
450 CX=CX+CD(R,1):CY=CY+CD(R,2)
460 MP(CX,CY)=R:PT(C,0)=CX:PT(C,1)=CY
470 PRINT "@";:GOTO 420
480 L=L+W:IF L<C THEN 400 ELSE IF C=MAX THEN 500
490 PRINT:L=1:W=W+(W=4)*3:GOTO 400
500 CLS
510 IF MS=1 THEN GOSUB 4000:GOTO 880
520 PRINT "PLAY LEVEL 1 IS THE EASIEST;"
```


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```
530 PRINT "3 IS THE HARDEST."
540 PRINT "AT WHICH LEVEL DO YOU WANT TO"
550 PRINT "PLAY?"
560 GOSUB 3000:LS=K-48:IF LS<1 OR LS>3 THEN 560
570 CLS:PRINT " DO YOU WANT TO PRINT A COPY OF"
580 PRINT TAB(3);"THE MAZE BEFORE YOU BEGIN?"
590 GOSUB 3000:IF K<>78 AND K<>89 THEN 590
600 IF K=89 THEN CLS:GOSUB 4000
610 CLS:LM=INT(16-MX/2):CX=2:CY=2:SC=0
620 PRINT@LM,"";:FOR X=1 TO MX:PRINT BK$;:NEXT X
630 PRINT@QY*32+LM,"";:FOR X=1 TO MX:PRINT BK$;:NEXT X
640 FOR Y=2 TO QY
650 PRINT@(Y-1)*32+LM,BK$;TAB(LM+QX);BK$;:NEXT Y
660 PRINT@32+LM,"S";
670 PRINT@(QY-1)*32+LM+QX,"E";:IF LS<>1 THEN 710
680 FOR Y=2 TO QY:PRINT@(Y-1)*32+LM+1,"";
690 FOR X=2 TO QX:PRINT CHR$(32-159*(MP(X,Y)=-1));
700 NEXT X,Y
710 PRINT@(CY-1)*32+LM+CX-1,"*";
720 GOSUB 3000
730 DX=(K=74)-(K=76):DY=(K=73)-(K=75)
740 IF DX=0 AND DY=0 THEN 720
750 TX=CX+DX:TY=CY+DY
760 IF MP(TX,TY)<>-1 THEN 820
770 SOUND 100,1:IF LS=1 THEN 720
780 SC=SC+1:PRINT@490-INT(LEN(STR$(SC))/2),"BLUNDERS =
";SC;
790 IF LS=3 THEN 720
800 IF TX=1 AND TY=2 THEN 720
810 PRINT@(TY-1)*32+LM+TX-1,BK$;:GOTO 720
820 PRINT@(CY-1)*32+LM+CX-1,SP$;
830 CX=TX:CY=TY:IF CX<>QX OR CY<>QY THEN 710
840 PRINT@(CY-1)*32+LM+CX-1,"*";
850 FOR L=1 TO 10:SOUND 100,2:FOR D=1 TO 15
860 NEXT D,L:PRINT@510,"";:FOR L=1 TO 16
870 FOR D=1 TO 70:NEXT D:PRINT:NEXT L
880 CLS:PRINT "DO YOU WANT TO GENERATE ANOTHER"
890 PRINT TAB(13);"MAZE?"
900 GOSUB 3000:IF K<>78 AND K<>89 THEN 900
910 IF K=89 THEN RUN ELSE END
1000 V=0:FOR Z=1 TO 3:T=RD(MP(CX,CY),Z)
1010 X=CX+CD(T,1):Y=CY+CD(T,2)
1020 IF X<2 OR X>QX OR Y<2 OR Y>QY THEN 1040
1030 IF MP(X,Y)<F THEN V=V+1:RP(V)=T
1040 NEXT Z:RETURN
2000 PRINT:PRINT "THE ";T$;" MUST BE AN ODD NUMBER ";
2010 PRINT "BETWEEN 9 AND";STR$(H);"."
2020 PRINT "WHAT ";T$;" DO YOU CHOOSE";:INPUT K$
2030 IF K$="" THEN 2020 ELSE K=INT(VAL(K$))
2040 IF K<9 OR K>H OR K/2=INT(K/2) THEN 2000
2050 RETURN
3000 K$=INKEY$:IF K$="" THEN E=RND(0):GOTO 3000
3010 K=ASC(K$):K=K-32*(K>96)*(K<123):RETURN
4000 PRINT "PRESS <ENTER> WHEN YOUR PRINTER"
4010 PRINT TAB(11);"IS READY."
4020 GOSUB 3000:IF K<>13 THEN 4020 ELSE PRINT#-2
4040 A$="*"
4050 B$=SP$
4060 S$="S"
4070 E$="E"
4090 FOR Y=1 TO MY
4110 FOR X=1 TO MX
4120 IF Y=2 AND X=1 THEN PRINT#-2,S$;:GOTO 4150
4130 IF Y=QY AND X=MX THEN PRINT#-2,E$;:GOTO 4150
4140 IF MP(X,Y)=-1 THEN PRINT#-2,A$; ELSE PRINT#-2,B$;
4150 NEXT X:PRINT#-2:NEXT Y:PRINT#-2
4170 PRINT:RETURN
5000 DATA 1,2,4,1,2,3,2,3,4,1,3,4
5010 DATA 0,-2,2,0,0,2,-2,0
```

OPTIONS FOR THE COLOR COMPUTER VERSION

1. If you don't have a printer, omit the program lines printed in red.

2. If you can change the "line pitch" (lines per inch or lpi) of your printer, change it to eight lines per inch in line 4080 and back to normal (usually six lines per inch) in line 4160. For example, if your printer manual says the command sequence for eight lpi is ESCAPE 1 and the sequence for six lpi is ESCAPE 2, you'd add the following lines to the program:

```
4080 PRINT#-2,CHR$(27);"1"
4160 PRINT#-2,CHR$(27);"2"
```

(Note that CHR$(27) is the equivalent of ESCAPE.)

3. If you have a 40-column printer, change line 60 to read as follows:

```
60 XR(1)=39:XR(2)=31:YR(1)=47:YR(2)=15
```

4. If your printer has Epson-compatible graphics capability, change lines 4040–4070 to read as follows:

```
4040 A$=CHR$(255):FOR X=2 TO 6:A$=A$+CHR$(255):NEXT X
4050 B$=CHR$(0):FOR X=2 TO 6:B$=B$+CHR$(0):NEXT X
4060 E$=CHR$(0)+CHR$(62)+CHR$(42)+CHR$(42)+CHR$(42)+CH
R$(34)
4070 S$=CHR$(52)+CHR$(82)+CHR$(74)+CHR$(74)+CHR$(36)+C
HR$(0)
```

Also, add lines 4030, 4080, 4100, and 4160:

```
4030 MB=6*MX:LB=INT(MB/256):FB=MB-LB*256
4080 PRINT#-2,CHR$(27);"1"
4100 PRINT#-2,CHR$(27);"K";CHR$(FB);CHR$(LB);
4160 PRINT#-2,CHR$(27);"2"
```

5. If you would like to use a joystick to move around the maze, change lines 720–740 to read as follows:

```
720 J0=JOYSTK(0):J1=JOYSTK(1)
730 DX=(J0<20)-(J0>43):DY=(J1<20)-(J1>43)
740 IF (DX=0)+(DY=0)<>-1 THEN 720
```

Tandy Models III & 4 (Model III mode) w/64K RAM & printer/*Maze Creator*

```
10 CLEAR 300:DEFINT A-Z
20 DIM CD(4,2),RD(4,3),RP(3),XR(2),YR(2)
30 MS=2:SP$=CHR$(32)
40 FOR I=1 TO 4:FOR J=1 TO 3:READ RD(I,J):NEXT J,I
50 FOR I=1 TO 4:FOR J=1 TO 2:READ CD(I,J):NEXT J,I
60 XR(1)=59:XR(2)=59:YR(1)=59:YR(2)=15
70 CLS:PRINT TAB(24);"* MAZE CREATOR *":PRINT
80 PRINT "Press <D> to display the maze on your screen
 or <P> to print it."
90 GOSUB 3000:MS=-(K=80)-2*(K=68)
100 IF MS=0 THEN 90 ELSE CLS
110 PRINT "The program is now set to generate a maze o
f size"
120 PRINT XR(MS);"x";YR(MS);"(width x height)."
130 PRINT "Do you want to change the size?"
140 GOSUB 3000:IF K<>78 AND K<>89 THEN 140
150 IF K=78 THEN MX=XR(MS):MY=YR(MS):GOTO 180
160 K$="":T$="width":H=XR(MS):GOSUB 2000:MX=K
170 K$="":T$="height":H=YR(MS):GOSUB 2000:MY=K
180 QX=MX-1:QY=MY-1:MAX=QX*QY/4
190 CLS:DIM MP(MX,MY),PT(MAX,1)
200 PRINT TAB(17);"I'm now generating your maze."
210 FOR X=1 TO MX:FOR Y=1 TO MY:MP(X,Y)=-1:NEXT Y,X
220 F=0:LC=MAX:C=1:CX=2:CY=2
230 PT(1,0)=2:PT(1,1)=2:MP(2,2)=2
240 GOSUB 1000:IF V<>0 THEN 290
250 R=MP(CX,CY):MP(CX-CD(R,1)/2,CY-CD(R,2)/2)=-1
260 MP(CX,CY)=0:C=C-1
270 PT(LC,0)=CX:PT(LC,1)=CY:LC=LC-1
280 CX=PT(C,0):CY=PT(C,1):PRINT "-";:GOTO 240
290 R=RP(RND(V)):TX=CX+CD(R,1):TY=CY+CD(R,2)
300 IF (R=1 AND (TX=2 OR TX=QX)) OR (R=4 AND (TY=2 OR
TY=QY)) THEN 290
310 MP(CX+CD(R,1)/2,CY+CD(R,2)/2)=5
320 C=C+1:CX=TX:CY=TY:MP(CX,CY)=R
330 PT(C,0)=CX:PT(C,1)=CY:PRINT "+";
340 IF CX<>QX OR CY<>QY THEN 240
350 PRINT:MP(QX,QY)=5:IF C=MAX THEN 470
360 F=1:W=4:L=1
370 PRINT "#";:CX=PT(L,0):CY=PT(L,1)
```

```
380 IF MP(CX,CY)=5 THEN 450
390 GOSUB 1000:IF V=0 THEN MP(CX,CY)=5:GOTO 450
400 R=RP(RND(V)):C=C+1
410 MP(CX+CD(R,1)/2,CY+CD(R,2)/2)=5
420 CX=CX+CD(R,1):CY=CY+CD(R,2)
430 MP(CX,CY)=R:PT(C,0)=CX:PT(C,1)=CY
440 PRINT "@";:GOTO 390
450 L=L+W:IF L<C THEN 370 ELSE IF C=MAX THEN 470
460 PRINT:L=1:W=W+(W=4)*3:GOTO 370
470 CLS
480 IF MS=1 THEN GOSUB 4000:GOTO 810
490 PRINT "Play level 1 is the easier; 2 is the harder
."
500 PRINT "At which level do you want to play?"
510 GOSUB 3000:LS=K-48:IF LS<1 OR LS>2 THEN 510
520 CLS:PRINT "Do you want to print a copy of the maze
 before you begin?"
530 GOSUB 3000:IF K<>78 AND K<>89 THEN 530
540 IF K=89 THEN CLS:GOSUB 4000
550 CLS:LM=32-MX/2:CX=2:CY=2:SC=0
560 PRINT@LM,STRING$(MX,191);
570 PRINT@QY*64+LM,STRING$(MX,191);
580 FOR Y=2 TO QY
590 PRINT@(Y-1)*64+LM,CHR$(191);TAB(LM+QX);CHR$(191);:
NEXT Y
600 PRINT@64+LM,"S";
610 PRINT@(QY-1)*64+LM+QX,"E";:IF LS=2 THEN 650
620 FOR Y=2 TO QY:PRINT@(Y-1)*64+LM+1,"";
630 FOR X=2 TO QX:PRINT CHR$(32-159*(MP(X,Y)=-1));
640 NEXT X,Y
650 PRINT@(CY-1)*64+LM+CX-1,"*";
660 GOSUB 3000
670 DX=(K=74)-(K=76):DY=(K=73)-(K=75)
680 IF DX=0 AND DY=0 THEN 660
690 TX=CX+DX:TY=CY+DY
700 IF MP(TX,TY)<>-1 THEN 750
710 IF LS=1 THEN 660
720 SC=SC+1:PRINT@987-INT(LEN(STR$(SC))/2),"BLUNDERS =
";SC;
730 IF TX=1 AND TY=2 THEN 660
740 PRINT@(TY-1)*64+LM+TX-1,CHR$(191);:GOTO 660
750 PRINT@(CY-1)*64+LM+CX-1,SP$;
760 CX=TX:CY=TY:IF CX<>QX OR CY<>QY THEN 650
770 PRINT@(CY-1)*64+LM+CX-1,"*";
780 FOR D=1 TO 100:NEXT D
790 PRINT@1000,"";:FOR L=1 TO 16
800 FOR D=1 TO 50:NEXT D:PRINT:NEXT L
810 CLS:PRINT TAB(12);"Do you want to generate another
 maze?"
820 GOSUB 3000:IF K<>78 AND K<>89 THEN 820
830 IF K=89 THEN RUN ELSE END
1000 V=0:FOR Z=1 TO 3:T=RD(MP(CX,CY),Z)
1010 X=CX+CD(T,1):Y=CY+CD(T,2)
1020 IF X<2 OR X>QX OR Y<2 OR Y>QY THEN 1040
1030 IF MP(X,Y)<F THEN V=V+1:RP(V)=T
1040 NEXT Z:RETURN
2000 PRINT:PRINT "The ";T$;" must be an odd number bet
ween 9 and";STR$(H);"."
2010 PRINT "What ";T$;" do you choose";:INPUT K$
2020 IF K$="" THEN 2010 ELSE K=VAL(K$)
2030 IF K<9 OR K>H OR K/2=INT(K/2) THEN 2000
2040 RETURN
3000 K$=INKEY$:IF K$="" THEN E=RND(0):GOTO 3000
3010 K=ASC(K$):K=K-32*(K>96)*(K<123):RETURN
4000 PRINT TAB(11);"Press <ENTER> when your printer is
 ready."
4010 GOSUB 3000:IF K<>13 THEN 4010 ELSE PRINT
4030 A$="*"
4040 B$=SP$
4050 E$="E"
4060 S$="S"
4080 FOR Y=1 TO MY
4100 FOR X=1 TO MX
4110 IF Y=2 AND X=1 THEN LPRINT S$;:GOTO 4140
4120 IF Y=QY AND X=MX THEN LPRINT E$;:GOTO 4140
4130 IF MP(X,Y)=-1 THEN LPRINT A$; ELSE LPRINT B$;
4140 NEXT X:LPRINT:NEXT Y:LPRINT
4160 LPRINT:RETURN
5000 DATA 1,2,4,1,2,3,2,3,4,1,3,4
5010 DATA 0,-2,2,0,0,2,-2,0
```

OPTIONS FOR THE MODEL III/4 VERSION

1. If you don't have a printer, omit the program lines printed in red.

2. If you can change the "line pitch" (lines per inch or lpi) of your printer, change it to eight lines per inch in line 4070 and back to normal (usually six lines per inch) in line 4150. For example, if your printer manual says the command sequence for eight lpi is ESCAPE 1 and the sequence for six lpi is ESCAPE 2, you'd add the following lines to the program:

```
4070 LPRINT CHR$(27);"1"
4150 LPRINT CHR$(27);"2"
```

(Note that CHR$(27) is the equivalent of ESCAPE.)

3. If you have a 40-column printer, change line 60 to read as follows:

```
60 XR(1)=39:XR(2)=39:YR(1)=59:YR(2)=15
```

4. If your printer has Epson-compatible graphics capability, change lines 4030–4060 to read as follows:

```
4030 A$=STRING$(6,255)
4040 B$=STRING$(6,0)
4050 E$=CHR$(0)+CHR$(62)+STRING$(3,42)+CHR$(34)
4060 S$=CHR$(52)+CHR$(82)+STRING$(2,74)+CHR$(36)+CHR$(
0)
```

Also, add lines 4020, 4070, 4090, and 4150:

```
4020 MB=6*MX:LB=MB/256:FB=MB-LB*256
4070 LPRINT CHR$(27);"1"
4090 LPRINT CHR$(27);"K";CHR$(FB);CHR$(LB);
4150 LPRINT CHR$(27);"2"
```

TIPS TO THE TYPIST

1. Do read instructions and program headings carefully.

2. Don't let fatigue and boredom contribute to inaccuracy. If you're new to programming, type in a longer program in easy stages, SAVEing each installment as you go.

3. Do assume that every character in a program listing must be copied accurately if a program is to work correctly.

4. Do watch out for potential trouble spots. About 90 percent of all typing errors occur in DATA statements.

5. Do be aware that our program listings are printed 54 characters wide. Thus, a single BASIC program "line" (sometimes called a "logical line") may appear as several lines in our listing. If you are typing along and reach the right margin of the printed listing, don't press RETURN or ENTER before checking to see if the program "line" you're typing really ends there.

6. To correct an error in a BASIC program line, type the line in again from the beginning, and press RETURN or ENTER to replace the old line.

COMPUTERS WE COVER

We regularly present two or more programs in each issue for the Apple II series; Atari 400/800, 600/800XL, & 130XE; Commodore 64 and 128 (in C 64 mode); IBM PC and compatibles; Macintosh; and Tandy Models III/4 and Color Computer. However, occasionally we have to omit versions when a program requires capabilities that some of these computers lack. For example, we usually won't run a Tandy Model III or 4 version of a program featuring sound and/or color graphics. And many Microtones programs can only run on computers that have three voices, which eliminates the Apple II series; IBM PC and compatibles (except the PC*jr* with Cartridge BASIC and the Tandy 1000); and Tandy Models III, 4, and Color Computer.

In addition, we publish at least one program each issue for the Adam, TI-99/4A, and VIC-20. In the future, we also hope to cover the Atari 520ST and the Amiga. This month, these programs can be found here in The Programmer and in Microtones (in the K-POWER section of FAMILY COMPUTING).

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AIR FORCE

This Month!!

GAME STRATEGY, page 72
MICROTONES, page 74
COMPUCOPIA, page 75
CONTEST, page 75

K-POWER®

Edited by Anne Krueger

FOR THE COMPUTER GENERATION

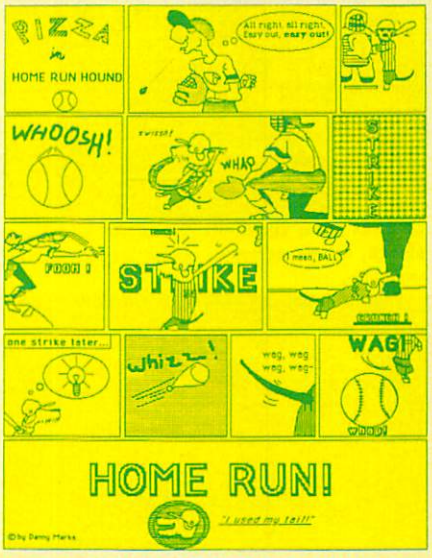
Can You Guess My Number? Page 75

Cartoonist Danny Marks Has a Mac Attack

It all began when Danny Marks started spending more time hanging around local computer stores in Pacific Grove, California, than he did at home. The reason? He couldn't stay away from the stores' Macintosh computers! Although a devoted Commodore 64 fan, once Danny discovered the Macintosh, he spent hours doodling and otherwise tapping the Mac's graphics capabilities. Each time Danny, 13, and his dad went to test the Mac, Danny would produce a new drawing while a crowd gathered around. "The sales personnel even kept copies of Danny's work in a specially created binder to use as promotional material," remembers Alan Marks, Danny's father.

Last summer Alan Marks, a professional writer, finally bought a Macintosh for its word-processing capabilities and—you guessed it—Danny's been staying home a lot more these days! In fact, he's been glued to the screen and logging in more hours than his dad! He's joined the new generation of artists who've discovered the unlimited possibilities of computer graphics.

An artist since the age of four, Danny first created pen-and-ink characters to cheer up his mom when she was in the hospital. He developed a comic strip modeled after the Marks' senior canine, Pizza. "She's named 'Pizza' because that's the only word that she'd ever respond to," says Danny. His mom loved the clever Pizza character and encouraged Danny to create others. (One of the family favorites is Pizza in "Home-Run Hound," left.)



Danny Marks used his head and his Macintosh computer to create Pizza in "Home-Run Hound," who says, "I used my tail!"

Over the years, Danny has created a collection of several comic strips and single-frame cartoons, as well as various vehicles and weapons. *(To win $25 and get your computer artwork published in* K-POWER, *see details of the Computer Masterpiece Contest, page 75.)*

Danny translated his comics into computer marvels on the Macintosh with the help of a program called *MacPaint*. "It's really fun to see what you can make with the computer," says Danny, who hopes to become a commercial artist someday. Although he still uses pen and ink and other traditional tools of the artist, Danny sees computers as the graphics tools of the future, and hopes to explore their capabilities. "I'm going to continue to practice on the computer and develop new characters," he says.—SUZETTE HARVEY

Software Scoop!

If you like mysteries, you're going to *die* over ***Ballyhoo***—the latest interactive fiction from **Infocom**. New Infocom writer **Jeff O'Neill** created this one, which transports you behind the glittery facade of the circus and plunges you into a world where crime and corruption take center stage. To solve the game (and find the circus owner's kidnapped daughter), you'll have to brave the beasts and poke around the Big Top for clues. *Ballyhoo* is available for the Apple II series, Macintosh, Atari XL/XE/520ST, C 64/128 , Amiga, and IBM PC and compatibles for $39.95. . . . For those who like their mysteries with a sci-fi flavor, take a gander at ***Brataccas***, available from **Mindscape**. Developed in England by a company called **Psygnosis Limited**, *Brataccas* gives you the role of a scientist called Kyne, who's discovered a genetic process for creating a superbeing! Well, you ought to know you can't create something like *that* without having all sorts of nasties come after you—so it's off to Brataccas to hide out. There you'll meet nearly 60 characters via "talk bubbles," many of whom you won't *want* to talk to! At $49.95, *Brataccas* is available for Atari 520ST, Amiga, and Macintosh computers. Bon voyage!

STRATEGY

TIPS, TRICKS, AND HINTS

AUTODUEL

Origin Systems. Role-playing arcade/adventure. Your mission: Survive on the highways of the future, "where the right of way goes to the biggest guns." You will design your own vehicle (any size from a subcompact to a van, complete with weapons, armor, power plant, and suspension), and take it out on the road. You may come home an ace—or crash and burn. If you survive, your abilities will improve, as will your car (if you bring home some salvage). You can fight for prizes in the arena, be a courier for the American AutoDuel Association (AADA), be a vigilante fighting the road outlaws and cycle gangs, or do all three . . . it's up to you. (Hints and game for Apple.)

Tips on construction:

1. We found that a pickup truck is the best buy. It has the highest weight capacity, and enough space to put in it almost anything you want. Although a van has more space, it can't hold as much weight.

2. If possible, always carry a rear-mounted flamethrower (one of the more effective weapons) and have a built-in smoke screen.

3. Although underside armor may seem useless, make sure you put some on. Mines are much more devastating than you might think.

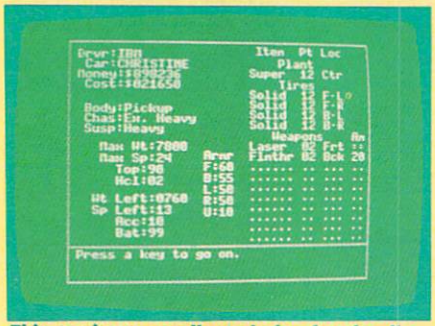
4. When you mount your weapons, always put the front ones on first. We found that side weapons are difficult to control; in fast-moving combat, it's hard to remember which side of your car is the right, and which is the left.

On a road that you don't know well, try to use other weapons besides lasers, which drain your car's battery. It's easy to get lost, and it often takes the charge of the whole battery to get you to your destination. If you drain the battery, you might end up stuck in the middle of the road. And passers-by will sooner shoot you than give you a lift anywhere.

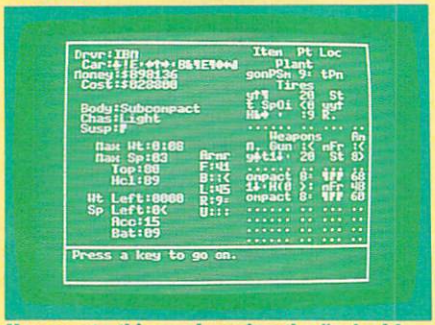
When you drive from Syracuse to Watertown, note the path you're using. On the return trip, there will be several different paths to choose from; choosing the wrong one will lead to a dead end and a dead battery.

Perhaps the biggest problem facing any aspiring auto duellist is the need for money. Here are a few ways (although risky) to rake in cash quickly:

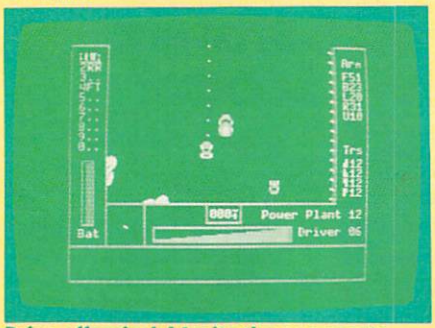
1. Once you've created a character, immediately save it when the game starts. Then, using a copy utility (the same one you used for making the original character disk), make one or two backups of your character disk. (Hereafter, the original character disk is referred to as Disk 1, and the backup as Disk 2.) Restart the game (using Disk 1 as your character disk), go to the assembly plant, and make a cheap car. Take the car into the garage, insert Disk 2, and store it.



This car is an excellent choice for deadly attack, tough defense, and a large carrying capacity.



You create this car by using the "valuable car hint."



Drive offensively! Ignite the opponents behind you with some well-placed flamethrower shots.

Now place Disk 1 in the drive and remove the car from the garage. When the menu appears, choose that car. Leave the garage and sell it at the salvage yard. Now go back to the garage and put in Disk 2, remove another car, put in Disk 1, and store it. Then reinsert Disk 2 and remove the car. Sell this car at the salvage yard, and keep repeating the car-copying and selling process until you have enough money to buy a better automobile. Furthermore, when you copy a car, you also copy any courier packages inside it. So if you are in the city in which you have to deliver the package, you can keep delivering it (and gaining more money and prestige) until the expiration date.

2. To get more money than you can ever use, follow these steps: With Disk 2 in the drive, take a car to the garage and store it. Then type in the command to remove your car from storage, but don't actually remove it. When the car menu appears, put Disk 1 in the drive and make your choice. Your car should look very strange—only one tire and a handling class of 80—but note the value. Take the car to the salvage yard and sell it. (Don't bother testing it in combat. Cars with one wheel are hard to control.) You should get between $300,000 and $500,000.

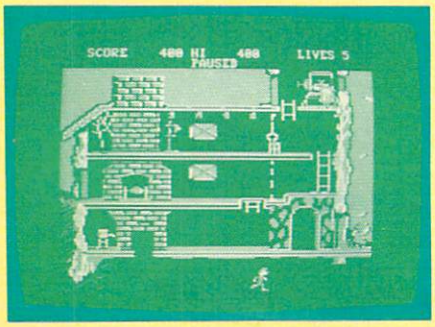
3. The last way to get money takes the most time and effort, but it's more honest. When you start out, make three or four copies of your character disk. Then restart the game and go to the casino in Atlantic City. Go to either the poker or blackjack tables (poker is safer, but blackjack is faster and you usually win more money) and bet all of your money. If you win, leave the casino. (Have willpower; it's all too easy to try "just one more time" and lose all of your money.)

Save the game and copy the disk with your winnings on all of the backups. If you lose all of your money, just turn off the computer and try it again with a different disk. Make sure you always have one disk you *never* use, except as a backup. If you run out of other copies, at least you can recopy over them using your backup. —CHRIS VAN KIRK, *18, New York, New York*; SPECIAL Ks

THE GOONIES

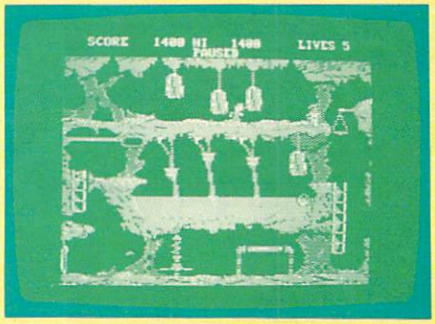
Datasoft. Arcade/skill. Your mission: Search the caves for One-Eyed Willy's Pirate Ship and get his treasure to pay the mortgage on your family's home. (Hints and game for Apple.)

Screen one: Push the chair under the ladder and stand on it to reach the ladder. Then have one Goonie operate the printing press



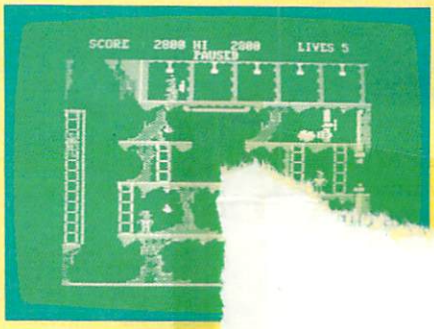
(upper right) while the other knocks over the watercooler (lower left) and goes through the trapdoor. Then rush the other Goonie down to the bottom as fast as possible.

Screen two: To rush under the huge stones, press yourself against the stone when it is all the way down. Keep pressing against the stone as it moves up, until it gets



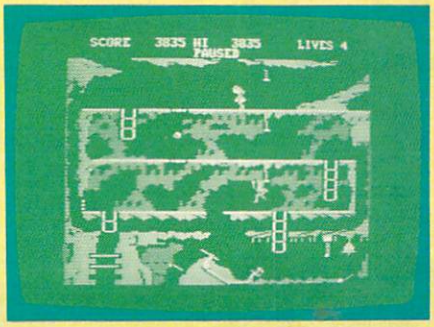
high enough to pass underneath. You should have plenty of time to pass underneath before the stone falls again.

Screen three: Always keep the Goonie that you're *not* moving safe from the sniper by hiding him to the



right of the wall or
tom tier. Always b
the sniper is if you
the open.

Screen four: Have one Goonie hang from the first chain, and one from the third chain. As the cannonball falls through the first hole, rush the upper Goonie down to the second tier and grab that chain. Then, once the ball falls to the third tier, keep it rolling back and forth by having the second Goonie get on and off the chain. At the same time, move the first Goonie into position at the right base of the mound in



the center of the bottom tier.

Once he's in position, let the ball drop through the middle hole. Put your Goonies into position to repeat
e two more times. Al-
at the lower

H I N T H

HARDBALL, Accolade (C 64). Sports simulation. Your mission: Beat your opponent (computer or human) in a baseball game.

In the beginning of the game, have your pitcher bat if you're playing the computer. When the lineup is shown, exchange your pitcher's position with another player's, then switch them back. Now you can replace your pitcher (in batting order *only*) with a good hitter. The pitcher will still pitch, but he won't bat, giving you an advantage over the computer. —DOUGLAS SCHONENBERG, *16, Orangeberg, New York*

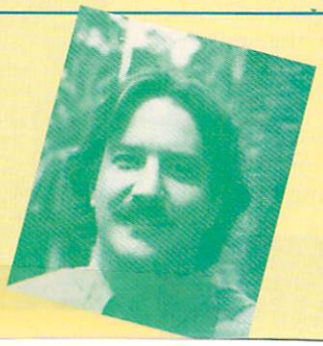
QUESTRON, Strategic Simulations (Apple, Atari, Commodore 64). Role-playing adventure.
Become the most p
the land and destro
er Mantor by steali
of Evil Magic.

When the ga
quickly run into Ge
you can be attacked
Then continue to M
a sling, rope, and h
to the mountains b
town and kill mons
points from wander
til you have a thous

With the thou
gold, play roulette. If
number is even, play
bers, and vice versa.

MUSIC PROGRAMS

BY JOEY LATIMER



FANFARE

A little music can really go a long way toward spicing up your BASIC programs. Without music or sound effects, a program can seem lifeless and dull. Music brings color and mood to programs—it breathes life into them!

Fanfare is a short music routine that you can run on its own or add to your existing BASIC programs. *Fanfare*'s snappy tune can serve to introduce a program or punctuate its climaxes.

COMMODORE 64 & 128 (C 64 MODE)/*FANFARE*

```
9 REM --PREPARATORY SECTION--
10 DIM H(26),L(26),D(26)
19 REM --CLEAR SOUND CHIP--
20 FOR I=0 TO 24
30 POKE 54272+I,0:NEXT I
38 REM --SET VOLUME, ATTACK/DECAY--
39 REM --SUSTAIN/RELEASE, AND WAVEFORM--
40 POKE 54296,15:POKE 54277,68
50 POKE 54278,120:POKE 54276,33
60 FOR I=1 TO 26
70 READ H(I),L(I),D(I):NEXT I
79 REM --"GOSUB 1000" PLAYS THE FANFARE--
80 GOSUB 1000:END
999 REM --"PLAY" SUBROUTINE--
1000 FOR I=1 TO 26
1010 POKE 54272,L(I):POKE 54273,H(I)
1020 FOR D=1 TO D(I)*25:NEXT D,I
1030 POKE 54276,0:RETURN
1999 REM --MUSIC DATA--
2000 DATA 16,195,2,18,209,2,21,31,2,22,96,2,28,49
2010 DATA 6,25,30,8,33,135,16,37,162,6,50,60,24,42
2020 DATA 62,1,37,162,1,33,135,1,31,165,1,28,49
2030 DATA 1,25,30,1,22,96,1,21,31,1,18,209,1,16
2040 DATA 195,1,15,210,1,14,24,1,12,143,8,0,0,4
2050 DATA 16,195,8,15,210,16,16,195,24
```

APPLE II SERIES/*FANFARE*

```
9 REM --PREPARATORY SECTION--
10 DIM N(26),D(26)
19 REM --READ IN MACHINE CODE FOR MAKING SOUND--
20 FOR I = 0 TO 36:READ A:POKE 768+I,A:NEXT I
30 FOR I = 1 TO 26:READ N(I),D(I):NEXT I
39 REM --"GOSUB 1000" PLAYS THE FANFARE--
40 GOSUB 1000:END
999 REM --"PLAY" SUBROUTINE--
1000 FOR I = 1 TO 26:POKE 6,10*D(I):POKE 8,N(I)
1010 CALL 768:NEXT I:RETURN
1999 REM --MACHINE LANGUAGE DATA--
2000 DATA 165,8,201,2,176,2,169,2,74,133,10,164,8
2010 DATA 240,8,173,48,192,234,234,136,208,251,56
2020 DATA 165,7,229,10,133,7,176,235,198,6,208,231,96
2999 REM --MUSIC DATA--
3000 DATA 182,2,162,2,144,2,136,2,108,6
3010 DATA 121,8,91,8,81,6,60,8,72,1
3020 DATA 81,1,91,1,96,1,108,1,121,1
3030 DATA 136,1,144,1,162,1,182,1,193,1
3040 DATA 217,1,244,8,0,4,182,8,193,8,182,8
```

IBM PC & COMPATIBLES/*FANFARE*

This program has been tested and found to work on the following computers and hardware configurations, using the BASICs shown: IBM PC w/Disk Basic D2.00 or Advanced BASIC A2.00. IBM PCjr w/Cartridge BASIC J1.00. Tandy 1000 w/GW-BASIC 2.02 version 00.05.00 or 01.01.00. It should also work on many other PC compatibles.

```
9 REM --PREPARATORY SECTION--
10 DIM N(26),D(26)
20 FOR I=1 TO 26:READ N(I),D(I):NEXT I
29 REM --"GOSUB 1000" PLAYS THE FANFARE--
30 GOSUB 1000:END
999 REM --"PLAY" SUBROUTINE--
1000 FOR I=1 TO 26:SOUND N(I),D(I)
1010 NEXT I:RETURN
1999 REM --MUSIC DATA--
2000 DATA 262,2,294,2,330,2,349,2,440,6,392,8
2010 DATA 523,8,587,6,784,8,659,1,587,1,523,1
2020 DATA 494,1,440,1,392,1,349,1,330,1,294,1
2030 DATA 262,1,247,1,220,1,196,8,30000,4
2040 DATA 262,6,247,8,262,16
```

TANDY COLOR COMPUTER/*FANFARE*

```
9 REM --PREPARATORY SECTION--
10 DIM N(25),D(25)
20 FOR I=1 TO 25
30 READ N(I),D(I):NEXT I
39 REM --"GOSUB 1000" PLAYS THE FANFARE--
40 GOSUB 1000:END
999 REM --"PLAY" SUBROUTINE--
1000 FOR I=1 TO 25
1010 SOUND N(I),D(I)
1020 NEXT I:RETURN
1999 REM --MUSIC DATA--
2000 DATA 176,2,185,2,193,2,197,2,210,6
2010 DATA 204,8,218,8,223,6,232,16,227,1
2020 DATA 223,1,218,1,216,1,210,1,204,1
2030 DATA 197,1,193,1,185,1,176,1,170,1
2040 DATA 159,1,147,8,176,6,170,8,176,8
```

COMPUCOPIA

SHORT PROGRAMS BY JOHN JAINSCHIGG

Guess My Number!

This little program demonstrates "binary searching," an efficient method of finding a specific value within a sorted list or range of values. A binary search works by dividing the range of values into two parts and determining which part contains the target value. Then, that part is itself divided in half, and so on. Pretty soon, only one value is left. Before RUNning *Guess My Number!*, make sure your computer is set to produce all capital letters.

ADAM & APPLE II SERIES/*GUESS MY NUMBER!*

```
10 PRINT "WHAT IS A NUMBER"
20 PRINT "GREATER THAN 0";
30 INPUT UB
40 IF UB < 1 THEN PRINT:GOTO 10
50 PRINT
60 PRINT "PLEASE THINK OF A NUMBER"
70 PRINT "BETWEEN 0 AND ";UB;"."
80 PRINT "I WILL FIND YOUR NUMBER WITH"
90 PRINT "NO MORE THAN ";INT(LOG(UB+1)/LOG(2)+0.9999);"
QUESTION(S)."
100 PRINT
110 LB = 0
120 P = INT((UB-LB)/2)
130 PRINT "IS YOUR NUMBER ";
140 IF UB-LB > 1 THEN PRINT:PRINT "GREATER THAN ";
150 PRINT LB+P;
160 INPUT Q$:Q$ = LEFT$(Q$,1)
170 IF Q$ <> "Y" AND Q$ <> "N" THEN 160
180 IF UB-LB < 2 THEN 220
190 IF Q$ = "Y" THEN LB = LB+P+1:GOTO 210
200 UB = LB+P
210 IF UB <> LB THEN 120
220 IF UB-LB <> 1 OR Q$ = "N" THEN PRINT "YOUR NUMBER
IS ";LB+(UB <> LB);"."
```

COMMODORE, IBM PC & COMPATIBLES /*GUESS MY NUMBER!*

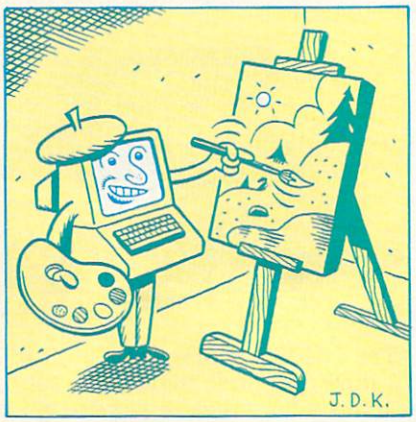
```
10 PRINT "WHAT IS A NUMBER"
20 PRINT "GREATER THAN 0";
30 INPUT UB
40 IF UB<1 THEN PRINT:GOTO 10
50 PRINT
60 PRINT "PLEASE THINK OF"
70 PRINT "A NUMBER BETWEEN"
80 PRINT "0 AND";UB
90 PRINT
100 PRINT "I WILL DETERMINE YOUR"
110 PRINT "NUMBER WITH NO MORE"
120 PRINT "THAN";INT(LOG(UB+1)/LOG(2)+.9999);"QUESTION
(S)"
130 PRINT
140 LB=0
150 P=INT((UB-LB)/2)
160 PRINT "IS YOUR NUMBER";
170 IF UB-LB>1 THEN PRINT:PRINT "GREATER THAN";
180 PRINT LB+P;
190 INPUT Q$:Q$=LEFT$(Q$,1)
200 IF Q$<>"Y" AND Q$<>"N" THEN 190
210 IF UB-LB<2 THEN 250
220 IF Q$="Y" THEN LB=LB+P+1:GOTO 240
230 UB=LB+P
240 IF UB<>LB THEN 150
250 IF UB-LB<>1 OR Q$="N" THEN PRINT "YOUR NUMBER IS";
LB-(UB<>LB)
```

MODIFICATIONS FOR ATARI 400/800, 600/800XL, & 130XE

Use the Adam and Apple II series version. Remove the expression `:Q$=LEFT$(Q$,1)` from line 160. Then, add line 5, below:

```
5 DIM Q$(1)
```

COMPUTER MASTERPIECE CONTEST



Attention, all you computer artists out there: Harness your computer's graphics capabilities and win $25! We'll select three of the best computer-generated works of art, award the cash, *and* publish your art and your photo in an upcoming issue of K-POWER. All you need to do is use your computer to create this masterpiece. You can use any kind of computer or software, and a graphics tablet or light pen, if you want. (Computer art, created by 13-year-old Danny Marks using a Macintosh and *MacPaint* software, appears on page 71.) Just send your art (comics accepted, too) along with this filled-out entry form to Computer Masterpiece Contest, K-POWER, 730 Broadway, New York, NY 10003, before May 23rd.

Name _____ Birthdate _____

Address _____

City _____ State _____ Zip _____

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Computer(s) you used to create your masterpiece _____

Software and/or peripherals you used _____

_____

Title of art or comic strip and explanation _____

_____

WHAT'S IN STORE

NEW HARDWARE ANNOUNCEMENTS

APPLE MACINTOSH PLUS • ATARI 1040ST
Two Computers with One Megabyte (1,000K) of Memory

BY NICK SULLIVAN

In 1982, when Jack Tramiel, founder and then president of Commodore, introduced the Commodore 64, 64K was a lot of memory, even for $595. After all, the Apple II plus, which sold for almost three times more, usually came with only 48K. But, with the introduction of the Apple IIe the next year, 64K became a standard memory configuration.

Now, three years later, the memory sweepstakes continues, with Jack Tramiel and Apple in their familiar roles. Tramiel, now chairman of Atari Corp., the largest privately held personal computer manufacturer in the U.S., recently introduced the Atari 1040ST, with one megabyte (actually 1,048,576 bytes) of RAM, or 16 times the memory of a 64K machine. Apple is just starting to market the Macintosh Plus, also with one megabyte of RAM. As before, the Tramiel machine sells for considerably less than the Apple machine, and is obviously aimed at individuals, rather than businesses. Still, what a horse race!

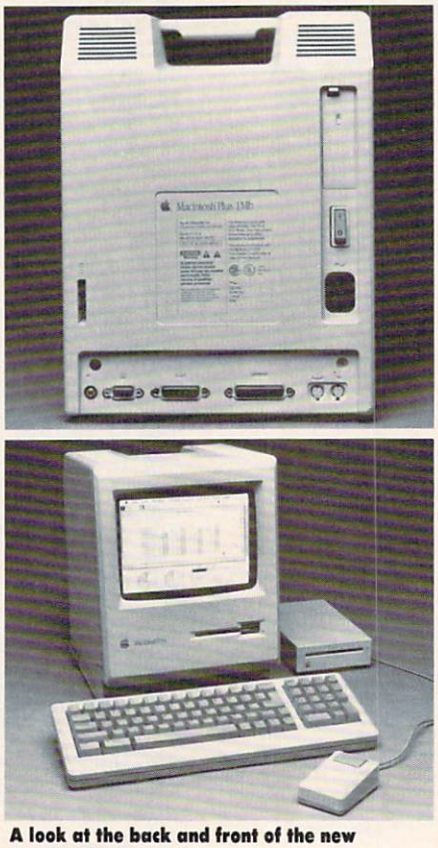
You may be saying to yourself that 64K or 128K is plenty of memory for most applications, and that 1,000K seems like overkill. While it's too early to predict how average users may handle all this memory, it's clear that software developers will have a field day. They will be able to write longer, more sophisticated programs. Because the programs will fit into memory at once, without having to access the disk drive, they will also be faster. The extra memory also means that the new generation of programs will have better sound and graphics, and probably will be easier to use.

May the best horse win. Better yet, may they both win.

Apple Macintosh Plus

MANUFACTURER: Apple Computer, 20525 Mariani Ave., Cupertino, CA 95014; (408) 996-1010
PRICE: $2,599

The Macintosh Plus has the same design and distinctive black-and-white user interface as previous Macintosh models, and comes with the now-traditional mouse. But the Plus also has one megabyte of RAM, and a new internal disk drive that stores 800K. Also new are arrow keys for cursor control and a keyboard with a numeric keypad, two elements lacking in the original Mac.



A look at the back and front of the new Macintosh Plus.

Software runs up to 50 percent faster on the Macintosh Plus, according to Apple. The increased speed is due partly to the increased memory, but also to improvements in the system software that makes the Macintosh series so graphic and easy to use.

The Macintosh Plus runs almost all of the programs written for the 128K and 512K Macintosh models, and supports all earlier Macintosh peripherals, including the LaserWriter and ImageWriter printers, the Hard Disk 20, and Apple modems. An AppleTalk connector is built into the new Mac for interoffice networks. In addition, the Mac Plus has two serial ports, an external disk-drive port, and a Small Computer System Interface (SCSI) port. The Macintosh Plus's memory will eventually be expandable to four megabytes, according to Apple.

Macintosh owners can buy the new disk drive ($299), keyboard ($129), and logic board with the new system software ($599–$799) from Apple dealers.

Atari 1040ST

MANUFACTURER: Atari Corp., Borregas Ave., Sunnyvale, CA; (408) 745-2000
PRICE: $999 (monochrome); $1,199 (color)

The Atari 1040ST, with one megabyte of RAM, is another member of the ST family. The TOS operating system, originally sold on disk with the 520ST, is now built into both machines on ROM chips, leaving more RAM for the user. The 1040ST comes with a monochrome monitor ($999) or a color monitor ($1,199). The 1040's color display equals that of the 520ST, which is spectacular (512 colors available). The 1040, of course, comes with a mouse, which works with most software. The keyboard has 10 function keys and a numeric keypad.

Also included with the 1040ST are ST BASIC, *1st Word* (word processing), ST LOGO, *NeoChrome* (a paint program), and VT-52 communications software. All 520ST software—a small but growing library—runs on the 1040ST.

The 1040ST, which has a built-in 3.5-inch disk drive that stores 720K, also has a hard-disk-drive port in the rear. At press time, Atari expected to be selling a 20-megabyte hard disk drive this month for $800. Also standard are parallel and serial ports, an external 3.5-inch disk-drive port, and MIDI "in" and "out" ports to attach music synthesizers. FC

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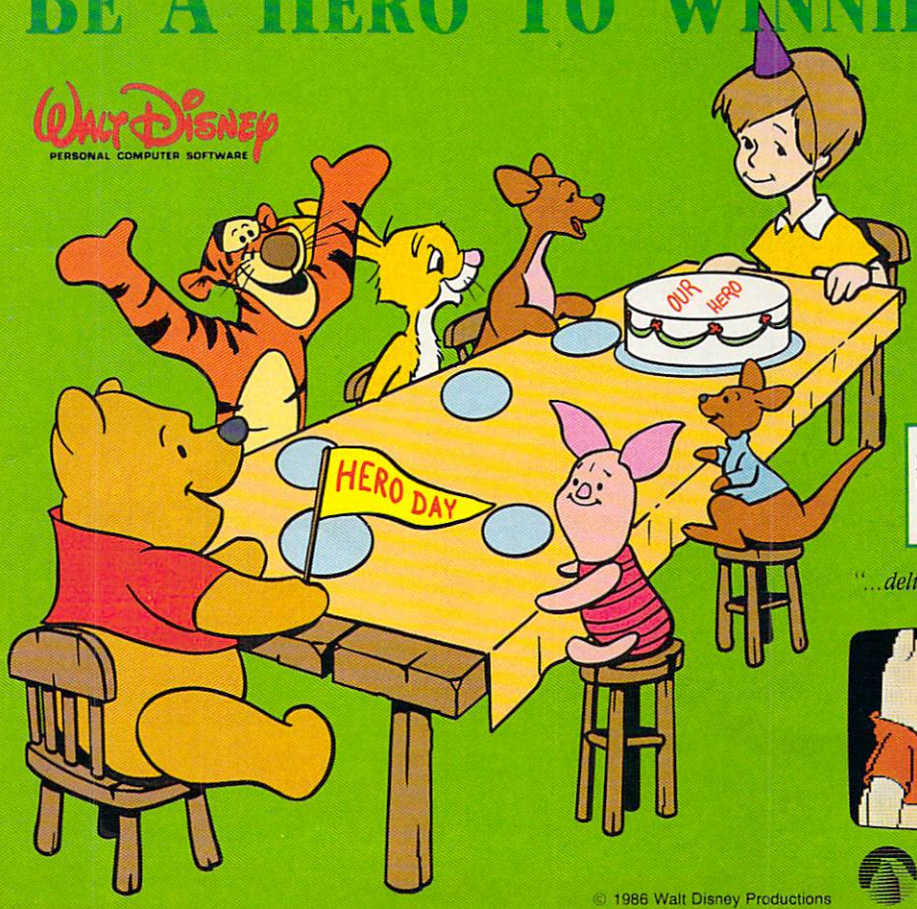

Last night the blustery wind came up and mixed up everything in the Hundred Acre Wood. If you can find the lost articles, like Pooh's honey pot and Eeyore's tail, and return them to their rightful owners, the characters in the Hundred Acre Wood will give a Hero Party in your honor!

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CIRCLE READER SERVICE 46

QUICK TAKES ON SOFTWARE— NEW AND NOTEWORTHY

Welcome to FAMILY COMPUTING's Software Guide, the most comprehensive listing available of two dozen of the newest, most noteworthy, and/or best programs on the market. Our reviewers include families from all over the country who have judged the software according to the following criteria: long-term benefits and applications, adaptability, and advantages of using a computer for a given task. More detailed reviews follow the chart. Unless otherwise noted, all programs are in disk format; minimum memory requirements are 48K for Apple II series, 48K for Atari, 128K for IBM PC/PC*jr* or compatibles, and 128K for Macintosh. Please note that "Atari" alone refers to the 800/XL/XE series, while "Atari ST" denotes the 520ST or 1040ST computers.

Here's a rundown of the rating categories and what they mean: **O** = Overall performance, given the limitations and capacities of the particular computer for which the software is intended. **D** = Documentation, or the instructions and literature that accompany a program. **EH** = Error-handling, the software's capacity to accommodate errors made by the user—an especially important consideration with software for younger users. **PS** = Play system, in the games reviews, the quality of the game design and the game's playability. **GQ** = Graphics quality, also evaluated in light of each particular brand's graphics capabilities. **EU** = Ease of use after the initial learning period, which varies from computer to computer. **V** = Value for money, or how the software measures up to its price.

HOME BUSINESS & PRODUCTIVITY

Title Publisher Price	Brief description	Hardware/ Equipment required	Backup policy	Ratings O	D	EH	GQ	EU	V
DATA MANAGER 128 Timeworks, Inc. 444 Lake Cook Rd. Deerfield, IL 60015 (312) 948-9200 $70 ©1983, 1985	Redesigned expressly for the C 128. An excellent data base that takes advantage of the computer's capabilities, including the extra memory and 80-column display. —ZORNBERG	C 128. RGB monitor or hi-res monochrome monitor for 80-column display.	90-day warranty. $7.50 thereafter.	★★★★	★★★	★★★	★★	E	★★★★
DELUXE MUSIC CONSTRUCTION SET Electronic Arts 2755 Campus Drive San Mateo, CA 94403 (415) 571-7171 $50 ©1985	Gives you more leeway in writing music than any other Mac music program. Enter notes directly on a staff, or click on the keys of your on-screen piano. An entirely new version and a great bargain, too. —AKER	Macintosh.	90-day warranty. $7.50 thereafter.	★★★★	★★★	★★★	★★★★	E	★★★★
THE INFORMATION CONNECTION Grolier Electronic Publishing Sherman Turnpike Danbury, CT 06816 (800) 858-8858 $40 (C 64); $60 (Apple, IBM) ©1985	A tutorial on using a modem, a simulation of going on-line, and an actual telecommunications program, all in one package. Presents materials clearly and simply. Good for children and adults.† —FRANK	Reviewed on Apple IIe/ IIc. Also for C 64/128, IBM PC/PC*jr*.* Modem.	90-day warranty. $10 thereafter or for backup.	★★★★	★★★	★★★	N/A	E	★★★★
THE PRINT SHOP COMPANION Broderbund Software 17 Paul Drive San Rafael, CA 94903 (415) 479-1170 $40 ©1985	Enhances *The Print Shop* with fine new tools for modifying and creating graphics. Also offers extra fonts and borders and the ability to edit them. Makes calendars and creatures, too. —SOLOMON	64K Apple. *The Print Shop*. Joystick, KoalaPad, mouse optional.	90-day warranty. $7.50 thereafter. User makes one backup.	★★★★	★★★	★★★	★★	E	★★★★
QUICKEN Intuit 540 University Ave. Palo Alto, CA 94301 (415) 322-0590 $79 (Apple); $99 (IBM) ©1985	Much more than mere checkbook-balancing software, *Quicken* can print checks, keep records, and provide sophisticated financial reports. Deserves applause for its ease of use.† —MORGENSTERN	Reviewed on 128K Apple IIe/IIc. Also for 192K IBM PC/PC*jr*.* Printer. 2nd drive recommended.	90-day warranty. $10 thereafter.	★★★★	★★★	★★★	N/A	E	★★★

RATINGS KEY **O** Overall performance; **D** Documentation; **EH** Error-handling; **GQ** Graphics quality; **EU** Ease of use; **V** Value for money; ★ Poor; ★★ Average; ★★★ Good; ★★★★ Excellent; N/A Not applicable; E Easy; A Average; D Difficult; † Longer review follows chart.

*Titles listed for the IBM PC/PC*jr* will also run on many IBM PC compatibles; due to the proliferation of compatibles, check with the publisher of the program or your dealer for exact compatibility.

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QTY.	DESCRIPTION	PRICE

Computer Type _____ SHIPPING

Phone No. _____ TOTAL

No additional surcharge on Mastercard, Visa, or School purchase orders. Personal checks allow 2 weeks. Shipping charges are $2.50 minimum. Ohio residents add 5½% state sales tax. Prices subject to change without notice.

EDUCATION/FUN LEARNING

Title Publisher Price	Brief description	Hardware/ Equipment required	Backup policy	Ratings O	D	EH	GQ	EU	V
BINGO BUGGLEBEE PRESENTS: HOME ALONE Quest Learning Systems 1103 Homer St. St. Paul, MN 55116 (800) 328-8322, ext.417 $20 ©1985	Using a bingo game for one player, this package presents situations "latchkey" kids might have to face when home alone. A low-key teaching tool that can help keep your child safe.† —ELTGROTH	Reviewed on Apple. Also for C 64/128.	30-day warranty.	★★★	★★★★	★★★★	★★	@	★★★★
BINGO BUGGLEBEE PRESENTS: OUTDOOR SAFETY Quest Learning Systems (*See above for address and phone*) $20 ©1985	From stopping when bicycle brakes fail, to picking unknown wild plants, *Bingo Bugglebee* presents dozens of situations for kids to think about. "Right" answers are the safest ones. —ELTGROTH	Reviewed on Apple. Also for C 64/128.	30-day warranty.	★★★	★★★★	★★★★	★★	@	★★★★
CHEM LAB Simon & Schuster, Inc. One Gulf & Western Plaza New York, NY 10023 (212) 333-5800 $40 © 1985	When experimenting with *this* chemistry kit, there's no mess, fuss, or danger. Young scientists (ages 12+) can indulge their creative fantasies without parental fear.† —MORRIS	Reviewed on 64K Apple. Also for C 64/128, IBM PC/PC*jr*.* Color monitor recommended.	30-day warranty. $5 thereafter up to one year.	★★★★	★★★★	★★	★★★★	A	★★★★
HOW TO WEIGH AN ELEPHANT Panda/Learning Technologies, Inc. 4255 LBJ Freeway, #131 Dallas, TX 75244 (214) 991-4958 $20 ©1985	With this imaginative group of three programs, children ages 4–7 learn about weight, mass, and volumes for liquids. Only one level of challenge in each game, but the three games' challenges balance each other. —FRANK	Reviewed on Apple. Also for C 64/128.	Unlimited warranty. $10 for backup.	★★★	★★★	★★★	★★★★	E	★★★
MICROZINE, VOL. 11 Scholastic Software 730 Broadway New York, NY 10003 (212) 505-3501 $40 ©1985	You get an adventure story, a make-your-own "Sticker Factory," a "Secret Coder" section, and more in this *Microzine* title. Not the best one in this fine series. —ZORNBERG	Apple. Color monitor recommended. Printer optional.	60-day warranty. $10 thereafter up to one year.	★★	★★★	★★	★★★★	A	★★
MR. & MRS. POTATO HEAD Random House Software 201 E. 50th St. New York, NY 10022 (212) 872-8035 $30–$40 ©1985	Select eyes, nose, ears, mouth, and clothing for an individual Potato Head character. Then kids ages 4+ can animate their "potatoes" and play a memory game. Lots of fun. —ELTGROTH	Reviewed on 64K Apple. Also for C 64/128. Color monitor, mouse, joystick optional.	90-day warranty. $5 thereafter up to one year. $12 for backup.	★★★★	★★★	★★★★	★★★★	E	★★★
SMART EYES Addison-Wesley Publishing Co. 1 Jacob Way Reading, MA 01867 (617) 944-3700 $60 ©1985	A reading-improvement program intended to increase your speed and comprehension. It's better at speed than understanding, because its materials are limited. —MORRIS	Reviewed on 64K Apple. Also for IBM PC/PC*jr*.* Macintosh. 2nd drive recommended.	90-day warranty.	★★	★★	★★	N/A	E	★★
S'MORE Cardco, Inc. 300 S. Topeka Wichita, KS 67202 (316) 267-6525 $70 ©1985	Insert this cartridge into your C 64, and BASIC programming memory will increase from 39K to 61K. *S'More* also enhances BASIC by offering new commands.† —LATIMER	C 64 (cart.).	Unlimited warranty.	★★★	★★★	★★	N/A	A	★★★
WORD BANK Learning Well 200 S. Service Rd. Roslyn Heights, NY 11577 (516) 621-1540 (800) 645-6564 $50 ©1985	What a wide selection of words for primary-school children to learn! Over 1,300 of them, grouped by difficulty into four levels, and by similarities into lists of eight to 12 words.† —ELTGROTH	Apple. Printer optional.	60-day warranty. $10 thereafter up to one year. $12 for backup.	★★★★	★★★	★★★★	★★	E	★★★

RATINGS KEY **O** Overall performance; **D** Documentation; **EH** Error-handling; **GQ** Graphics quality; **EU** Ease of use; **V** Value for money: ★ Poor; ★★ Average; ★★★ Good; ★★★★ Excellent; N/A Not applicable; E Easy; A Average; D Difficult; @ Easy to difficult, depending on child's background; † Longer review follows chart.

*Titles listed for the IBM PC/PC*jr* will also run on many IBM PC compatibles; due to the proliferation of compatibles, check with the publisher of the program or your dealer for exact compatibility.

Make Any Computer Do Exactly What You Want With McGraw-Hill's

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From Writing Your Own Programs to Modifying Existing Software, Here's the New, Easy, and Low Cost Way to Unlock the Secrets of Your Computer

Whether you use computers for business, for personal applications, or for fun, off-the shelf programs will never do everything you want them to do for you. That's because they were written by programmers to satisfy what they perceived as the needs of the greatest number of potential users—often missing some or many of your specific needs.

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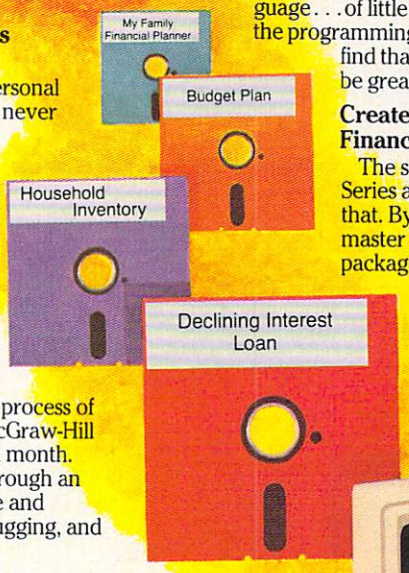

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GAMES REVIEWS BY JAMES DELSON

Title Publisher Price	Brief description	Hardware/ Equipment required	Backup policy	Ratings O	D	PS	GQ	EU	V
BATTLE OF ANTIETAM Strategic Simulations 883 Stierlin Road Mountain View, CA 94903 (415) 964-1200 $50 ©1985	A brilliant simulation of the bloodiest day in American military history. With all the elements vital to war games and great ease of use, this one's for all levels, ages 12+.†	Reviewed on Apple. Also for Atari, C 64.	30-day warranty. $10 thereafter.	★ ★ ★ ★	★ ★ ★ ★	★ ★ ★ ★	★ ★ ★	D	★ ★ ★ ★
BRIDGE BARON Great Game Products 8804 Chalon Dr. Bethesda, MD 20817 (800) 426-3748 $40–$50 ©1985	Polish your bidding and finessing against the Bridge Baron, who can deal over a million different hands. Best for the experienced, since the game lacks a hint feature and multiple play levels.	Reviewed on 64K Apple. Also for Atari, C 64/ 128, IBM PC/PC*jr*.*	90-day warranty. $5 thereafter.	★ ★ ★	★ ★	★ ★ ★	★ ★	A	★ ★ ★
CHAMPIONSHIP BOXING Sierra On-Line, Inc. Sierra On-Line Building Coarsegold, CA 93614 (209) 683-6858 $25–$40 ©1984	Not only do you build boxers from a construction set, you get to "coach" them, too. The game offers nonarcade fans a chance to compete with joystick-lovers on an even level. For ages 10+.†	Reviewed on C 64/128. Also for Apple, IBM PC/ PC*jr*,* Macintosh.	90-day warranty. $5 thereafter.	★ ★ ★	★ ★ ★	★ ★ ★	★ ★	E	★ ★ ★
DRAGONWORLD Trillium Software, a division of Spinnaker One Kendall Square Cambridge, MA 01239 (617) 494-1200 $33–$50 ©1984	Save the last dragon on your planet from destruction or die trying! Some arcade skills are required in this text/graphic adventure for ages 12+. Based on the best-selling fantasy novel.	Reviewed on C 64/128. Also for Apple, Atari 520ST, Macintosh, IBM PC/PC*jr*.* Joysticks, mouse optional.	30-day warranty. $10 thereafter.	★ ★ ★	★ ★ ★	★ ★ ★	★ ★ ★	A	★ ★ ★
ESCAPE Bantam Software 666 Fifth Ave. New York, NY 10103 (212) 765-6500 $35 ©1985	You're a spy with valuable information and trying to escape the country in this arcade adventure. Although challenging for players at all levels, best-suited for beginners and youngsters ages 10+.	Reviewed on C 64/128. Also for 64K Apple.	90-day warranty (includes user-damaged). $5 thereafter.	★ ★ ★	★ ★	★ ★ ★	★ ★	E	★ ★ ★
FOKKER TRIPLANE FLIGHT SIMULATOR Bullseye Software, distributed by PBI Software, Inc. 1111 Triton Drive, #101 Foster City, CA 94404 (415) 349-8765 $60 ©1985	A thrilling World War I simulation, this game puts you behind the stick of a Fokker triplane, the kind the Red Baron used to pilot. Learn to fly, then try aerial combat, bombing runs, balloon-bursting, and rescue missions. For ages 10+.†	Macintosh.	90-day warranty.	★ ★ ★ ★	★ ★ ★ ★	★ ★ ★ ★	★ ★ ★	A	★ ★ ★
HARDBALL Accolade, Inc. 20863 Stevens Creek Blvd. Cupertino, CA 95014 (408) 446-5757 $30–$35 ©1985	A computer-baseball game in which you manage the team, yet also hit, pitch, run, and field. Combines traditional baseball strategy with good old-fashioned joystick action. Fun for ages 10+.	Reviewed on C 64/128. Also for Apple. Joystick(s) required for C 64/128; optional for Apple.	90-day warranty. $6 thereafter. $10 for backup.	★ ★ ★	★ ★	★ ★ ★ ★	★ ★ ★	E	★ ★ ★
MOEBIUS Origin Systems, distributed by Electronic Arts 2755 Campus Drive San Mateo, CA 94403 (415) 571-7171 $60 ©1985	As a martial-arts novice, your goal is restoring harmony to the once-peaceful land of your forefathers. Go one-on-one against evil in this role-playing adventure; for ages 12+.	Apple.	90-day warranty. $6 thereafter.	★ ★ ★	★ ★ ★	★ ★ ★	★ ★ ★	D	★ ★
SUPERMAN: THE GAME First Star Software 18 E. 41st St. New York, NY 10017 (212) 532-4666 $25–$35 ©1985	A children's strategy/arcade game that pits Superman against his archenemy, Darkseid, in a battle for control of Metropolis. Will goodness triumph? Only those ages 6+ will be able to resolve the action.	Reviewed on C 64/128. Also for Apple, Atari. Joystick(s).	90-day warranty. $6 thereafter.	★ ★	★	★ ★ ★	★ ★ ★	E	★ ★ ★
TOUCHDOWN FOOTBALL Imagic, distributed by Electronic Arts *(See above for address and phone)* $30–$35 ©1984	The football action is a thrill a minute as you call the shots for seven-man teams. Choose from hundreds of formations. The flexible play system is a gem. Recommended for ages 10+.	Reviewed on C 64/128. Also for IBM PC*jr*.	90-day warranty. $7.50 thereafter.	★ ★ ★	★ ★	★ ★ ★ ★	★ ★ ★	A	★ ★ ★ ★

RATINGS KEY **O** Overall performance: **D** Documentation: **PS** Play system: **GQ** Graphics quality: **EU** Ease of use: **V** Value for money: ★ Poor; ★★ Average; ★★★ Good; ★★★★ Excellent; N/A Not applicable; E Easy; A Average; D Difficult; † Longer review follows chart.

*Titles listed for the IBM PC/PC*jr* will also run on many IBM PC compatibles; due to the proliferation of compatibles, check with the publisher of the program or your dealer for exact compatibility.

A Printer For All Reasons

Search For The Best High Quality Graphic Printer

If you have been looking very long, you have probably discovered that there are just too many claims and counter claims in the printer market today. There are printers that have some of the features you want, but do not have others. Some features you probably don't care about, others are vitally important to you. We understand. In fact, not long ago, we were in the same position. Deluged by claims and counter claims. Overburdened by rows and rows of specifications, we decided to separate all the facts — prove or disprove all the claims to our own satisfaction. So we bought printers. We bought samples of all the major brands and tested them.

Our Objective Was Simple

We wanted to find that printer which had all the features you could want and yet be sold directly to you at the lowest price. We didn't want a "close-out special" of an obsolete product that some manufacturer was dumping, so we limited our search to only those new printers that had the latest proven technology. We wanted to give our customers the **best** printer on the market today at a low price.

The Results Are In

Our search is over. We have reduced the field to a single printer that meets all our goals (and more). The printer is the APROTEK SP-1000 manufactured by a Division of Seiko, the world class manufacturer of many fine products from Japan.We ran this printer through our battery of tests and it came out shining. This printer *can* do it all. Standard draft printing at a respectable 100 characters per second, and with a very readable 12 (horizontal) by 9 (vertical) character matrix. This is a full feature, bi-directional, logic seeking, true descender printer.

"NLQ" Mode

One of our highest concerns was about print quality and readability. This printer has a print mode termed Near Letter Quality printing (NLQ mode). This is where we outshine all the competition. Hands down! The character matrix in NLQ mode is a very dense 24 (horizontal) by 18 (vertical). This equates to 41,472 addressable dots per square inch. Now we're talking ***quality*** printing. It looks like it was done on a typewriter. You can even print graphics using the standard graphics symbols built into your computer. The results are the best we've ever seen. The only other printers currently available having resolution this high sell for hundreds more.

Features That Won't Quit

With the SP-1000 your computer can now print 40, 48, 68, 80, 96, or 136 characters per line. You can print in ANY of scores of styles including double width and reversed (white on black) styles. You not only have the standard Pica, Elite, Condensed and Italics, but also true Superscripts and Subscripts. Never again will you have to worry about how to print H_2O or X^2. This fantastic machine will do it automatically, through easy commands right from your keyboard. Do you sometimes want to emphasize a word? It's easy, just use **bold** (double strike) or use *italics* to make the words stand out. Or, if you wish to be even more emphatic, underline the words. You can combine many of these modes and styles to make the variation almost endless. Do you want to express something that you can't do with words? Use graphics with your text — even on the same line. You have variable line spacing of 1 line per inch to infinity (no space at all) and 143 other software selectable settings in between. You can control line spacing on a dot-by-dot basis. If you've ever had a letter or other document that was just a few lines too long to fit a page, you can see how handy this feature is. Simply reduce the line spacing slightly and . . . VOILA! The letter now fits on one page.

Forms? Yes! Your Letterhead? Of Course!

Do you print forms? No problem. This unit will do them all. Any form up to 10 inches wide. The tractors are adjustable from 4 to 10 inches. Yes, you can also use single sheets. Plain typing paper, your letterhead, short memo forms, labels, anything you choose. Any size to 10" in width. In fact this unit is so advanced, it will load your paper automatically. Multiple copies? Absolutely! Use forms (up to 3 thick). Do you want to use spread sheets with many columns? Of course! Just go to condensed mode printing and print a full 136 columns wide. Forget expensive wide-carriage printers and changing to wide carriage paper. You can now do it all on a standard 8½" wide page, and you can do it quietly, it's only 55dB. This is much quieter than any other impact dot matrix printer that we know of and is quieter than the average office background noise level.

Consistent Print Quality

Most printers have a ribbon cartridge or a single spool ribbon which gives nice dark printing when new, but quickly starts to fade. To keep the printers output looking consistently dark, the ribbons must be changed quite often. We solve this problem by using a wide (½") ribbon cartridge that will print thousands of pages before needing replacement. (When you finally do wear out your ribbon, replacement cost is only $11.00. Order *#2001. (Also Locally Available.)*

The Best Part

When shopping for a printer with this quality and these features, you could expect to pay much more. *Not now!* We sell this fantastic printer for **only $219.95! You need absolutely nothing else to start printing — just add paper (single sheet or fanfold tractor).**

No Risk Offer

We give you a 2-week satisfaction guarantee. If you are not completely satisfied for any reason we will promptly refund your purchase. The warranty has now been extended to 2 years. The warranty repair policy is to repair or replace and reship to the buyer within 72 hours of receipt.

The Bottom Line

Be sure to specify the order # for the correct version printer designed for your computer.

Commodore C-64 & C-128, Order **#2200**, graphics interface & cable built in. $219.95

IBM-PC and compatibles, Order **#2100**, $239.95 plus 8' shielded cable **#1103**, $26.00

Apple IIc & Macintosh Order **#2300**, $239.95 with cable.

Standard Parallel with 36 pin Centronics connector, Order **#2400**, $239.95 no cable.

Standard Serial with RS-232 (DB-25) Connector, Order **#2500**, $239.95 no cable.

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C-7 Adventure Master
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C-9 Bits, Pieces and Clues
C-10 Board Games 1
C-11 Board Game Challengers
C-12 Chess Champion
C-13 Crazy Corners
C-14 Galactic Empire Builder
C-15 Just Games (With a Twist!)
C-16 Land, Sea & Air Adventures
C-17 Maze Madness!
C-18 Peg Out (The Cribbage Game)
C-19 Star Trek Evolution
C-20 Trivia Quest
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C-25 Ulysses & the Golden Fleece
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C-64 When?
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C-66 Gingerbread Man
C-67 Baby Animals
C-68 Hoppy the Curious Kangaroo
C-69 Wild Animals
C-70 Tom Thumb
C-71 I Was a Second Grade Werewolf
C-72 Tough Eddie

For the Apple II+, IIc, IIe

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Total amount of order ..... $_____
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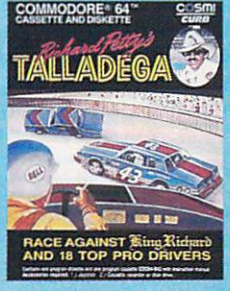

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CIRCLE READER SERVICE 11

WHAT'S IN STORE
SOFTWARE REVIEWS

On the following pages, you'll find in-depth reviews of some of the programs listed in the Software Guide. Refer back to the Guide on page 78 for information such as backup policies and addresses of software publishers.

HOME BUSINESS & PRODUCTIVITY

The Information Connection

HARDWARE REQUIREMENTS: Apple IIe/IIc, C 64/128, IBM PC/PC*jr*.
PUBLISHER: Grolier Electronic Publishing
PRICE: $40 (C 64); $60 (Apple, IBM)

We've had a modem hooked up to our computer for at least a year, yet I never ventured beyond our local bulletin boards, for fear of what my phone bill might look like if I got lost in the maze of a major communication service.

Then we tried *The Information Connection*, a three-in-one telecomputing package. It includes a tutorial on modem use and a practice simulation of a commercial data base, Grolier's own Academic American Encyclopedia (AAE). Best of all, *The Information Connection* is a solid little communications utility.

The clear and simple tutorial is an interactive, graphic lesson on the basics of going on-line. The practice session allows you to simulate using a computerized encyclopedia without the expense. Your challenge is to log on-line with a national network, access the AAE, and use it to find the answers to three questions.

When you're actually telecomputing, *The Information Connection* is versatile and easy to use. It operates with 300-, 1200-, and 2400-baud modems, and features an adequate editor for writing and editing text or capturing information that appears on-screen. Files created or captured in the editor are easily saved to disk or printed directly after you go offline. It is also possible to use the program to send files created by separate word processors that save standard text files; however, the otherwise satisfactory instructions could be clearer on that subject.

The practice module was just what I needed to explore an on-line data base without fear of bankruptcy. Both my 10-year-old daughter (who is quite computer literate) and my husband (who is not) practiced with this program, too, and immediately wanted to go on-line for real. They both succeeded in logging on to a local bulletin board and wandering through the various menus. Now we're awaiting the arrival of our CompuServe membership kit.

—CATHY FRANK

Quicken

HARDWARE REQUIREMENTS: 128K Apple IIe/IIc, IBM PC/PC*jr*.
PUBLISHER: Intuit
PRICE: $79 (Apple); $99 (IBM)

Programs to balance your checkbook are nothing new. They've been around for years, and practically no one uses them. Why bother entering all that information into a computer just to do a little adding and subtracting?

Quicken is different. It's the first program I've seen that makes computer checking worthwhile. *Quicken* does more than keep a complete record of your checking-account activity, though. It actually prints business-sized checks on your computer's printer and updates your checkbook register at the same time. The program makes balancing your checking account a snap, and also helps organize your records for budgeting and taxes.

A model of easy-to-use software, *Quicken* offers excellent on-screen instructions and a terrific manual. Its graphic style and keystroke commands are borrowed from *AppleWorks*. To print a check, you simply fill in the blank check that appears on-screen. The information you enter is automatically carried over to a register that looks just like the familiar paper register. Deposits and other transactions are quickly inserted into the register as well.

Balancing your checkbook is simple, but the program's real power is in its retrieval of information by date, payee, memo notation, or any combination of the three. For example, if you note "medical" on each check to a doctor, pharmacy, or hospital, you can easily make *Quicken* print out a report of your yearly medical expenses. *AppleWorks* users will find *Quicken* an especially powerful number-crunching tool, since it lets you transfer checkbook data into an *AppleWorks* spreadsheet.

You will have to make a few adjustments in your bill-paying routine to use *Quicken* efficiently. You'll need a supply of special printer/form-feed checks (an order form is included). And since you have to remove your regular computer paper to put these checks into your printer, writing your checks in batches will work best. If you're attempting to keep your financial affairs organized, however, these are small prices to pay for the convenience of *Quicken*.

—STEVE MORGENSTERN

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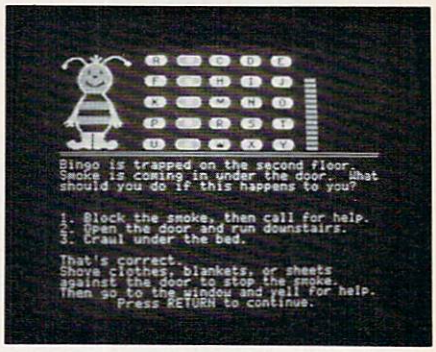


Bingo Bugglebee Presents: Home Alone

HARDWARE REQUIREMENTS: Apple, C 64/128.
PUBLISHER: Quest Learning Systems
PRICE: $20
PUBLISHER'S SUGGESTED AGES: 8–13

Almost everyone with a child coming home to an empty house is concerned by the "latchkey" plight. I'm no exception, so *Bingo Bugglebee Presents: Home Alone* caught my attention immediately. A bingo game for one player, this program presents situations kids may face after school, and invites them to respond by selecting an action for each case. Kids receive "coins" for right answers, and Bingo does a little dance at the end of each set of correctly answered questions. Both right and wrong answers are followed by brief explanations.

I thought it was a great idea, and looked forward to trying it with my 10-year-old son. Unfortunately, the name *Bingo Bugglebee* put him off. Each time he sat down at the computer, he selected other programs instead. I finally insisted, promising I'd play his favorite race-car game with him if he'd try it. After all my waiting, it was reassuring, if disappointing, to watch John work his way through the questions, attain-

ing a perfect "Bingo" the first time in each set.

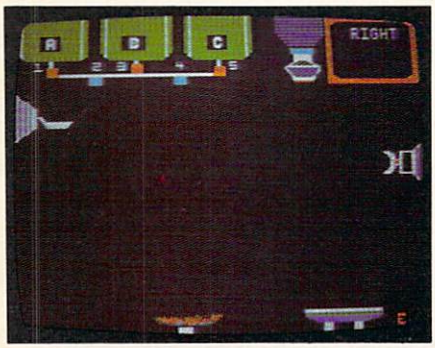
It's important to know that *Bingo Bugglebee* is not a high-resolution graphics game guaranteed to catch your child's attention. This program is a low-key teaching tool, and a way to review some of the vital safety rules for any child alone at home. Children like John, accustomed to arcade-like games, may find it dull. Other children who played it at our house, however, found it more of a challenge.

The age range suggested by the publisher seems wide. I think the program is most useful for children ages 7–10. *Bingo Bugglebee Presents: Home Alone* is a different kind of a computer game. The name of the package is definitely a turnoff, but if you can get beyond that, it's worth exploring.

—MARLENE BUMGARNER ELTGROTH

Chem Lab

HARDWARE REQUIREMENTS: 64K Apple, C 64/128, IBM PC/PC*jr*.
PUBLISHER: Simon & Schuster, Inc.
PRICE: $40
PUBLISHER'S SUGGESTED AGES: 12+



Could you make table salt from sodium hydroxide, hydrochloric acid, water, hydrogen, and oxygen? What about making acetylene from calcium carbide, sodium chloride, carbon disulfide, water, hydrochloric acid, and nitrogen?

With *Chem Lab*, you make these compounds and dozens more. The program is a complete, computerized chemistry lab that simulates more than 150 chemicals and all the necessary equipment needed to conduct hundreds of experiments. No mess, fuss, or danger—it's all on-screen. Which is not to say that things don't go BANG! in the night. In fact, the entire lab may blow sky-high on occasion, but a simple reboot sets everything right. This means young scientists can indulge their creative fantasies without parental fear.

The documentation is substantial, with basic material on chemical formulas, compounds, and reactions. What's most valuable are the 50 simple-to-advanced experiments that get you started along the road to discovery. These are not step-by-step, follow-the-leader experiments. You are given a list of raw materials and a target substance; from there, it's up to you to figure out how to combine the materials to produce the target. *Chem Lab* fosters exploration, in which the *process* of finding a solution is as valuable for learning as the solution itself is.

Our criticisms were few, but significant. If you want to review your goals after starting an experiment, you must begin again from scratch. For example, once a flask is corked (intentionally or not), it cannot be uncorked. All this means you must plan ahead, which may be difficult if you don't know what to plan for in

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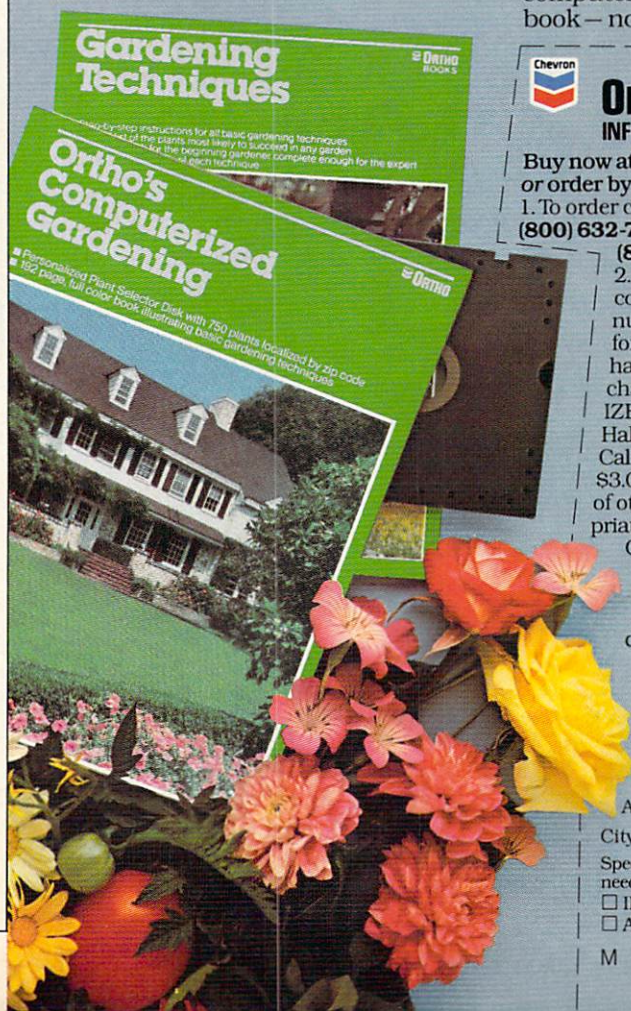

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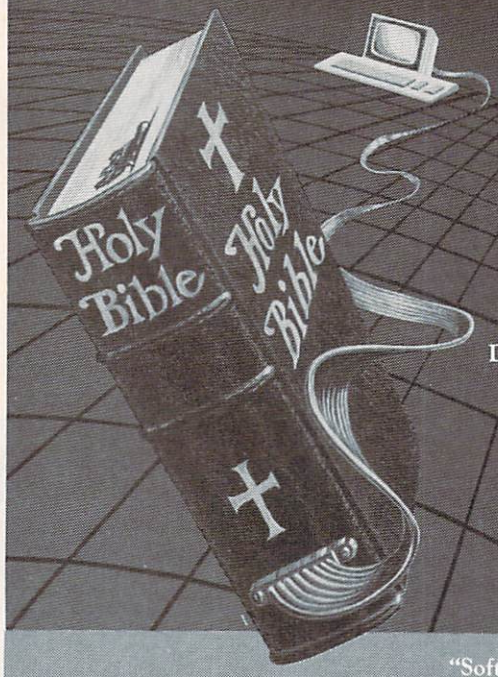

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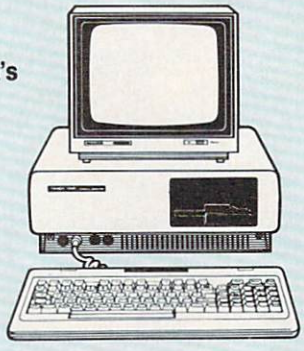

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CIRCLE READER SERVICE 20

SOFTWARE REVIEWS

the first place. Such programming rigidity is inconsistent with the general thrust of *Chem Lab*: to play around, try different things, and see what happens. —TONY MORRIS

S'More

HARDWARE REQUIREMENTS: C 64.
PUBLISHER: Cardco, Inc.
PRICE: $70
PUBLISHER'S SUGGESTED AGES: All

One type of utility program is a tool for programmers: software to help write software. Utilities can help make up for a computer system's shortcomings by letting it act like a much more powerful machine. The *S'More* cartridge does just that for the Commodore 64.

When a "stock" C 64 is turned on, a message on-screen informs you that there are 38,911 bytes of free memory (space for BASIC programs), about 25K less than you might expect from a 64K-byte machine. The *S'More* cartridge increases the memory you can use for programs to a full 61,183 bytes. As an added bonus, burned into the cartridge's read-only memory (ROM) is a virtual truckload of new BASIC commands to fill up your new-found memory.

On a standard C 64, listing a program and stopping on the line you want can be difficult. With *S'More* BASIC, once you list any part of the program to the screen, you use the cursor keys to scroll up or down to see the rest of the program. This feature creates a feeling of editing BASIC programs on a word processor.

PRINT USING and (RE)NUMBER are just two of the many *S'More* BASIC commands found on other computers, but left out of the BASIC language built into the C 64. The first command allows decimal points to line up evenly on-screen when you're working with dollars and cents. The second makes it easier to renumber lines in a BASIC program. Other commands, such as BORDER, PAPER, INK, and KEY, let you change border color, screen color, character color, and function keys, all without having to use complicated POKE statements or printed character strings.

Whether you program a C 64 for recreation or for work, *S'More*'s utility can fill a need in your software library. —JOEY LATIMER

Word Bank

HARDWARE REQUIREMENTS: Apple.
PUBLISHER: Learning Well
PRICE: $50
PUBLISHER'S SUGGESTED AGES: 6–9

The first thing I noticed about the *Word Bank* vocabulary program was its graphics mode. It isn't used to create cutesy pictures, but for *large* uppercase and lowercase letters—the same ones young children learn to read in school. The next thing I noticed was the software's wide selection of words (over 1,300), grouped by difficulty into four levels. Within each level, words were organized by subject (animals, toys, etc.), or by long vowels/short vowels, into lists of eight to 12 words.

In Side by Side, the first game of four levels, children can place words into two categories, long vowels and short vowels. While the short-vowel words are similar in each level, the long-vowel words are presented in orderly groups. For example, Level I long-vowel words all have silent "e's," such as "make," "time," or "side." Level II long-vowel words may be two vowels together (like "boat" or "rain"), double vowels (such as "seem" or "feet"), or "y" words ("say," "day," or "cry"). The next two levels offer similar patterns.

Grouping words in coherent patterns makes sense. An excellent aid for children, the groups help them develop sight-recognition and classification skills, which, when combined with phonics, allow them to decode new words.

Drop in the Box, Window Shopping, and Picture Frame-up—the three other games—deliver additional and enjoyable ways to learn new words. Children move words around the screen with the arrow keys. When a child places a word in the wrong location, it simply returns to where it started. This way, children are encouraged to try again and again, until they place the word in the correct category.

Word Bank is a fine program. I highly recommend it for families with beginning readers.

—MARLENE BUMGARNER ELTGROTH

GAMES

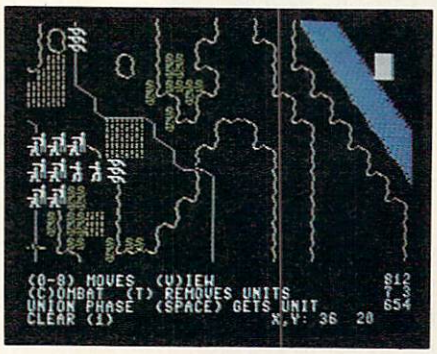
Battle of Antietam

HARDWARE REQUIREMENTS: Apple, Atari, C 64.
PUBLISHER: Strategic Simulations, Inc.
PRICE: $50
CRITIC'S SUGGESTED AGES: 12+

Although there have been only two Civil War computer games in the past four years (*The Road to Gettysburg* and *The Battle of Chickamauga*), each marked a significant innovation in the field of strategy and tactics. Now, the latest, *Battle of Antietam*, follows its predecessors by taking the war-game genre into fresh territory.

A re-creation of the bloodiest day in American military history, *Antietam* equals the best from *Chickamauga*, and more. *Antietam*'s added details are abundant, with the ability to plot and then take back moves, view line of sight for all units, achieve flanking fire in attack and defense, and have routed units rally and rejoin the battle.

Playtesters went wild over *Antietam*. Over the course of several weeks, as many as three games were going on at once. The key to the



game's success is in its easy-to-use command-control system. Once you master the lengthy but well-written rules, every hour spent at the keyboard makes using the refined play system closer to second nature. This allows full concentration on the superb game.

You're offered three levels of play and a host of options. They include one- or two-player modes, hidden movement, and gradual activation of the historically superior Union forces to balance play. More fine details can be found, and the computer opponents are challenging, too. Thus far, the year's best war game.

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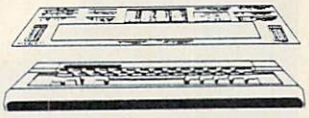

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WHAT'S IN STORE
SOFTWARE REVIEWS

Championship Boxing

HARDWARE REQUIREMENTS: Apple, C 64/128, IBM PC/PC*jr*, Macintosh.
PUBLISHER: Sierra On-Line, Inc.
PRICE: $25–$40
CRITIC'S SUGGESTED AGES: 10+

The dominant genre in computer gaming for the past year has been strategy/arcade, which explains the slew of role-playing adventures and construction sets written to expand the field. Games like *Fight Night* and *Competition Karate* let you create your own boxers or martial-arts champs. You then control those warriors in combat, watching them "grow" as a result of victory.

For those among us who aren't completely adept with joysticks, a game in which you can "coach" your fighters during a match, instead of controlling them directly, is great. This is the strength of *Championship Boxing*, a new construction set.

One or two gamers can either match fighters, which the computer provides, or build their own. When

you're in the ring, you can, if you wish, fully control each of your boxer's moves. Or, in nonarcade mode, you can stand back and let the computer handle the punching while you manage your fighter.

Playtesters found the game enjoyable, the construction set intriguing, and the boxing absorbing, but felt the graphics were barely acceptable. However, this game's different approach to the genre offers the chance for nonarcade fans to compete equally with joystick-lovers.

Fokker Triplane Flight Simulator

HARDWARE REQUIREMENTS: Macintosh
PUBLISHER: Bullseye Software
PRICE: $60
CRITIC'S SUGGESTED AGES: 10+

You're sitting in a canvas, piano wire, and wood "crate" during World War I—a flying machine called the "Fokker Triplane." Instead of the two-wing design favored by the Allies, the German aircraft engineers have added a third wing for stabilization. It's such a marvel of contemporary engineering that Baron Von Richthoffen himself, the "Red Baron," will fly one into action.

With your instrument panel displayed on-screen, and your mouse-controlled "stick" in your hand, you learn how to taxi, take off, fly and perform aerobatics, and then land. Once you're sure of your skills, there are dogfights in which you can practice your shooting abilities (against armed or unarmed foes), bombing runs, balloon-bursting and more.

Although it takes a while to master the mouse as a flying stick, it eventually feels quite natural. Without the self-centering joystick to contend with, you get a better sense of seat-of-the-pants flying than in any other nonjet plane program yet.

Fokker Triplane Flight Simulator was much applauded by playtesters.

—REVIEWS BY JAMES DELSON

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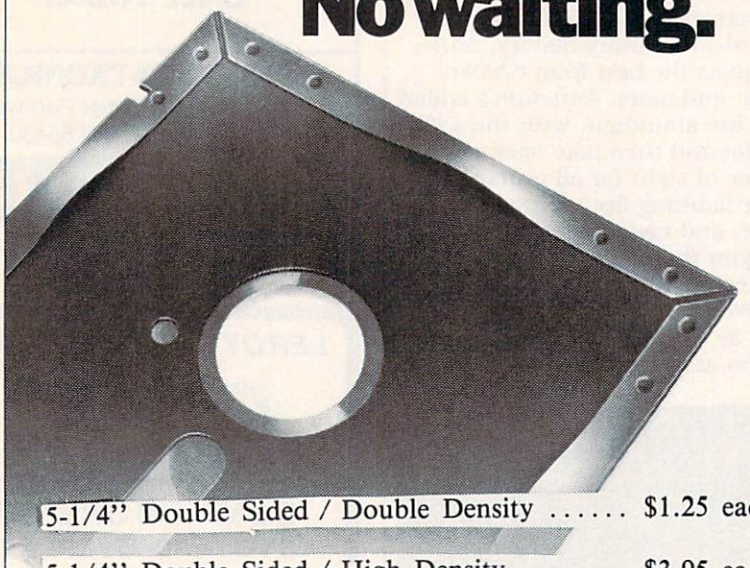

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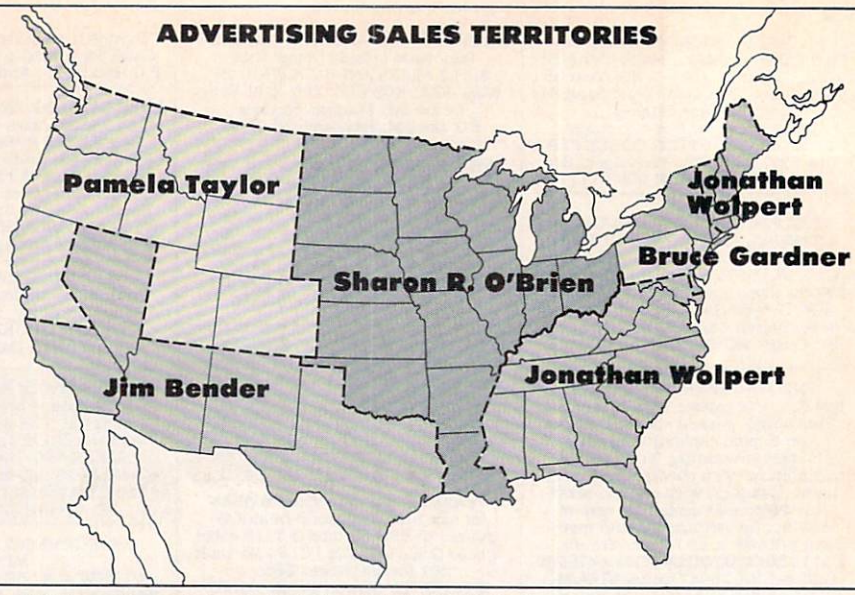

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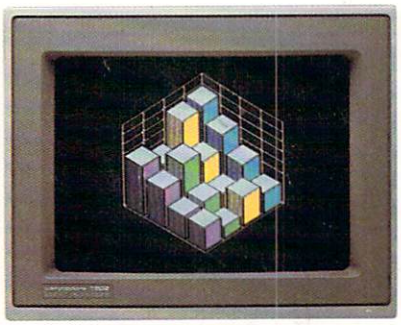

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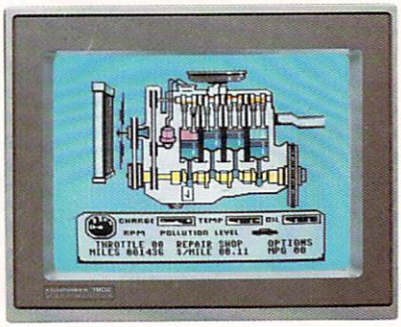

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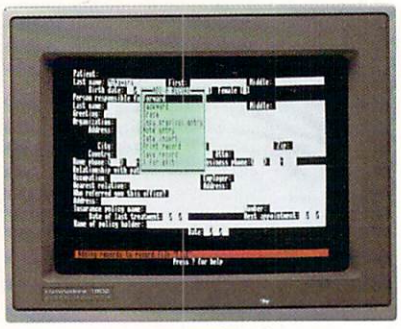

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COMMODORE 128 AND 64 PERSONAL COMPUTERS

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CIRCLE READER SERVICE 10

```
4030 MB=6*MX:LB=INT(MB/256):FB=MB-LB*256
4090 PRINT #2;CHR$(27);"1"
4110 PRINT #2;CHR$(27);"K";CHR$(FB);CHR$(LB);
4180 PRINT #2;CHR$(27);"2"
```

5. If you would like to use a joystick to move around the maze, change lines 760 and 770 to read as follows:

```
760 J=STICK(0):DX=(J=7)-(J=11)
770 DY=(J=13)-(J=14)
```

Commodore 64 & 128 (C 64 mode) w/printer/
Maze Creator

```
10 POKE 650,128:POKE 649,1:PRINT CHR$(5)
20 DIM CD(4,2),RD(4,3),RP(3),XR(2),YR(2)
30 MS=2:BK$=CHR$(166):CL$=CHR$(147):SP$=CHR$(32)
40 FOR I=1 TO 4:FOR J=1 TO 3:READ RD(I,J):NEXT J,I
50 FOR I=1 TO 4:FOR J=1 TO 2:READ CD(I,J):NEXT J,I
60 XR(1)=59:XR(2)=39:YR(1)=59:YR(2)=23
70 S=54272:FOR X=0 TO 24:POKE S+X,0:NEXT X
80 POKE S+5,9:POKE S+6,0:POKE S+1,100:POKE S+24,15
90 PRINT CL$;TAB(52);"* MAZE CREATOR *":PRINT
100 PRINT " PRESS <D> TO DISPLAY THE MAZE ON YOUR"
110 PRINT TAB(5);"SCREEN OR <P> TO PRINT IT OUT.";
120 GOSUB 3000:MS=-(K=80)-2*(K=68)
130 ON -(MS=0) GOTO 120:PRINT CL$;
140 PRINT "THE PROGRAM IS NOW SET TO GENERATE A"
150 PRINT "MAZE OF SIZE";XR(MS);"X";YR(MS);"(WIDTH X H
EIGHT)."
160 PRINT "DO YOU WANT TO CHANGE THE SIZE?"
170 GOSUB 3000:IF K<>78 AND K<>89 THEN 170
180 IF K=78 THEN MX=XR(MS):MY=YR(MS):GOTO 210
190 K$="":T$="WIDTH":A=XR(MS):GOSUB 2000:MX=K
200 K$="":T$="HEIGHT":A=YR(MS):GOSUB 2000:MY=K
210 QX=MX-1:QY=MY-1:MAX=QX*QY/4
220 PRINT CL$;:DIM MP%(MX,MY),PT%(MAX,1)
230 PRINT TAB(5);"I'M NOW GENERATING YOUR MAZE."
240 FOR X=1 TO MX:FOR Y=1 TO MY:MP%(X,Y)=-1:NEXT Y,X
250 F=0:LC=MAX:C=1:CX=2:CY=2
260 PT%(1,0)=2:PT%(1,1)=2:MP%(2,2)=2
270 GOSUB 1000:IF V<>0 THEN 320
280 R=MP%(CX,CY):MP%(CX-CD(R,1)/2,CY-CD(R,2)/2)=-1
290 MP%(CX,CY)=0:C=C-1
300 PT%(LC,0)=CX:PT%(LC,1)=CY:LC=LC-1
310 CX=PT%(C,0):CY=PT%(C,1):PRINT "-";:GOTO 270
320 R=RP(RND(1)*V+1):TX=CX+CD(R,1):TY=CY+CD(R,2)
330 IF(R=1 AND (TX=2 OR TX=QX)) OR (R=4 AND (TY=2 OR T
Y=QY)) THEN 320
340 MP%(CX+CD(R,1)/2,CY+CD(R,2)/2)=5
350 C=C+1:CX=TX:CY=TY:MP%(CX,CY)=R
360 PT%(C,0)=CX:PT%(C,1)=CY:PRINT "+";
370 IF CX<>QX OR CY<>QY THEN 270
380 PRINT:MP%(QX,QY)=5:IF C=MAX THEN 510
390 F=1:W=4:L=1
400 PRINT "#";:CX=PT%(L,0):CY=PT%(L,1)
410 IF MP%(CX,CY)=5 THEN 480
420 GOSUB 1000:IF V=0 THEN MP%(CX,CY)=5:GOTO 480
430 R=RP(RND(1)*V+1):C=C+1
440 MP%(CX+CD(R,1)/2,CY+CD(R,2)/2)=5
450 CX=CX+CD(R,1):CY=CY+CD(R,2)
460 MP%(CX,CY)=R:PT%(C,0)=CX:PT%(C,1)=CY
470 PRINT "@";:GOTO 420
480 L=L+W:IF L<C THEN 400
490 IF C=MAX THEN 510
500 PRINT:L=1:W=W+(W=4)*3:GOTO 400
510 PRINT CL$;
520 IF MS=1 THEN GOSUB 4000:GOTO 910
530 PRINT "PLAY LEVEL 1 IS THE EASIEST; 3 IS THE"
540 PRINT "HARDEST."
550 PRINT "AT WHICH LEVEL DO YOU WANT TO PLAY?"
560 GOSUB 3000:LS=K-48:IF LS<1 OR LS>3 THEN 560
570 PRINT CL$;"DO YOU WANT TO PRINT A COPY OF THE MAZE
"
580 PRINT "BEFORE YOU BEGIN?"
590 GOSUB 3000:IF K<>78 AND K<>89 THEN 590
600 IF K=89 THEN PRINT CL$;:GOSUB 4000
610 PRINT CL$;:LM=INT(20-MX/2):CX=2:CY=2:SC=0 ——→
```


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CIRCLE READER SERVICE 17

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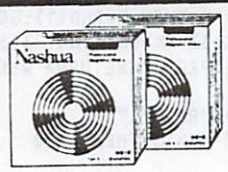

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CIRCLE READER SERVICE 52

```
620 FOR Y=1 TO MY:POKE 214,Y-1:PRINT
630 PRINT TAB(LM);BK$;SPC(QX-1);BK$;:NEXT Y
640 FOR X=LM+2 TO LM+QX:POKE 214,0:PRINT
650 PRINT TAB(X-1);BK$;
660 POKE 214,MY-1:PRINT:PRINT TAB(X-1);BK$;:NEXT X
670 POKE 214,1:PRINT:PRINT TAB(LM);"S";
680 POKE 214,QY-1:PRINT
690 PRINT TAB(LM+MX-1);"E";:IF LS<>1 THEN 730
700 FOR Y=2 TO QY:POKE 214,Y-1:PRINT:PRINT SPC(LM+1);
710 FOR X=2 TO QX:PRINT CHR$(32-(MP%(X,Y)=-1)*134);
720 NEXT X,Y
730 POKE 214,CY-1:PRINT:PRINT TAB(LM+CX-1);"*";
740 GOSUB 3000
750 DX=(K=74)-(K=76):DY=(K=73)-(K=75)
760 IF DX=0 AND DY=0 THEN 740
770 TX=CX+DX:TY=CY+DY
780 IF MP%(TX,TY)<>-1 THEN 850
790 POKE S+4,17:FOR D=1 TO 100:NEXT D
800 POKE S+4,16:IF LS=1 THEN 740
810 SC=SC+1:POKE 214,23:PRINT
820 PRINT TAB(14-INT(LEN(STR$(SC))/2));"BLUNDERS =";SC
;:IF LS=3 THEN 740
830 IF TX=1 AND TY=2 THEN 740
840 POKE 214,TY-1:PRINT:PRINT TAB(LM+TX-1);BK$;:GOTO 7
40
850 POKE 214,CY-1:PRINT:PRINT TAB(LM+CX-1);SP$;
860 CX=TX:CY=TY:IF CX<>QX OR CY<>QY THEN 730
870 POKE 214,CY-1:PRINT:PRINT TAB(LM+CX-1);"*";
880 FOR L=1 TO 10:POKE S+4,17:FOR D=1 TO 100:NEXT D
890 POKE S+4,16:NEXT L:POKE 214,24:PRINT
900 FOR L=1 TO 24:FOR D=1 TO 70:NEXT D:PRINT:NEXT L
910 PRINT CL$;"DO YOU WANT TO GENERATE ANOTHER MAZE?"
920 GOSUB 3000:IF K<>78 AND K<>89 THEN 920
930 IF K=89 THEN RUN
940 POKE S+24,0:END
1000 V=0:FOR Z=1 TO 3:T=RD(MP%(CX,CY),Z)
1010 X=CX+CD(T,1):Y=CY+CD(T,2)
1020 IF X<2 OR X>QX OR Y<2 OR Y>QY THEN 1040
1030 IF MP%(X,Y)<F THEN V=V+1:RP(V)=T
1040 NEXT Z:RETURN
2000 PRINT:PRINT "THE ";T$;" MUST BE AN ODD NUMBER"
2010 PRINT "BETWEEN 9 AND";STR$(A);"."
2020 PRINT "WHAT ";T$;" DO YOU CHOOSE";:INPUT K$
2030 IF K$="" THEN 2020
2040 K=INT(VAL(K$)):IF K<9 OR K>A OR K/2=INT(K/2) THEN
 2000
2050 RETURN
3000 GET K$:IF K$="" THEN E=RND(1):GOTO 3000
3010 K=ASC(K$):K=K+32*(K>96)*(K<123):RETURN
4000 PRINT TAB(2);"PRESS <RETURN> WHEN YOUR PRINTER IS
"
4010 PRINT TAB(17);"READY."
4020 GOSUB 3000:IF K<>13 THEN 4020
4040 A$="*"
4050 B$=SP$
4060 S$="S"
4070 E$="E"
4080 OPEN 4,4
4100 FOR Y=1 TO MY
4120 FOR X=1 TO MX
4130 IF Y=2 AND X=1 THEN PRINT#4,S$;:GOTO 4170
4140 IF Y=QY AND X=MX THEN PRINT#4,E$;:GOTO 4170
4150 IF MP%(X,Y)=-1 THEN PRINT#4,A$;:GOTO 4170
4160 PRINT#4,B$;
4170 NEXT X:PRINT#4:NEXT Y:PRINT#4
4190 PRINT#4:CLOSE 4
4200 PRINT:RETURN
5000 DATA 1,2,4,1,2,3,2,3,4,1,3,4
5010 DATA 0,-2,2,0,0,2,-2,0
```

OPTIONS FOR THE COMMODORE VERSION

1. If you don't have a printer, omit the program lines printed in red.

2. If you can change the "line pitch" (lines per inch or lpi) of your printer, change it to eight lines per inch in line 4090 and back to normal (usually six lines per inch) in line 4180. For example, if your printer manual says the command sequence for eight lpi is ESCAPE 1 and the sequence for six lpi is ESCAPE 2, you'd add the following lines to the program:

```
4090 PRINT#4,CHR$(27);"1"
4180 PRINT#4,CHR$(27);"2"
```

(Note that CHR$(27) is the equivalent of ESCAPE.)

3. If you have a 40-column printer, change line 60 to read as follows:

```
60 XR(1)=39:XR(2)=39:YR(1)=59:YR(2)=23
```

4. If your printer has Epson-compatible graphics capability, change lines 4040–4070 to read as follows:

```
4040 A$=CHR$(255):FOR X=2 TO 6:A$=A$+CHR$(255):NEXT X
4050 B$=CHR$(0):FOR X=2 TO 6:B$=B$+CHR$(0):NEXT X
4060 E$=CHR$(0)+CHR$(62)+CHR$(42)+CHR$(42)+CHR$(42)+CH
R$(34)
4070 S$=CHR$(52)+CHR$(82)+CHR$(74)+CHR$(74)+CHR$(36)+C
HR$(0)
```

Also, add lines 4030, 4090, 4110, and 4180:

```
4030 MB=6*MX:LB=INT(MB/256):FB=MB-LB*256
4090 PRINT#4,CHR$(27);"1"
4110 PRINT#4,CHR$(27);"K";CHR$(FB);CHR$(LB);
4180 PRINT#4,CHR$(27);"2"
```

5. If you would like to use a joystick to move around the maze, change lines 740 and 750 to read as follows:

```
740 J=PEEK(56321) AND 15
750 DX=(J=11)-(J=7):DY=(J=14)-(J=13)
```

IBM PC & compatibles (40-column version) w/ printer/*Maze Creator*

This program has been tested and found to work on the following computers and hardware configurations, using the BASICs shown. IBM PC w/Color/Graphics Monitor Adapter, w/Disk BASIC D2.00 or Advanced BASIC A2.00. IBM PCjr w/Cartridge BASIC J1.00. Tandy 1000 w/GW-BASIC version 00.05.00 or 01.01.00.

```
10 DEF SEG=0:DEFINT A-Z:SCREEN 0,0:KEY OFF
20 SW=40
40 DIM CD(4,2),RD(4,3),RP(3),XR(2),YR(2)
50 WIDTH SW:LOCATE ,,0:MS=2:SP$=CHR$(32)
60 FOR I=1 TO 4:FOR J=1 TO 3:READ RD(I,J):NEXT J,I
70 FOR I=1 TO 4:FOR J=1 TO 2:READ CD(I,J):NEXT J,I
80 XR(1)=59:XR(2)=39:YR(1)=59:YR(2)=23
90 CLS:PRINT:PRINT TAB(13);"* MAZE CREATOR *":PRINT
100 PRINT " Press <D> to display the maze on your"
110 PRINT TAB(6);"screen or <P> to print it out.";
120 GOSUB 3000:MS=-(K=80)-2*(K=68)
130 IF MS=0 THEN 120 ELSE CLS
140 PRINT "The program is now set to generate a"
150 PRINT "maze of size";XR(MS);"x";YR(MS);"(width x h
eight)."
160 PRINT "Do you want to change the size?"
170 GOSUB 3000:IF K<>78 AND K<>89 THEN 170
180 IF K=78 THEN MX=XR(MS):MY=YR(MS):GOTO 220
190 POKE 1050,PEEK(1052)
200 T$="width":H=XR(MS):GOSUB 2000:MX=K
210 T$="height":H=YR(MS):GOSUB 2000:MY=K
220 QX=MX-1:QY=MY-1:MAX=QX*QY/4
230 CLS:DIM MP(MX,MY),PT(MAX,1)
240 PRINT TAB(6);"I'm now generating your maze."
250 FOR X=1 TO MX:FOR Y=1 TO MY:MP(X,Y)=-1:NEXT Y,X
260 F=0:LC=MAX:C=1:CX=2:CY=2
270 PT(1,0)=2:PT(1,1)=2:MP(2,2)=2
280 GOSUB 1000:IF V<>0 THEN 330
290 R=MP(CX,CY):MP(CX-CD(R,1)/2,CY-CD(R,2)/2)=-1
300 MP(CX,CY)=0:C=C-1
310 PT(LC,0)=CX:PT(LC,1)=CY:LC=LC-1
320 CX=PT(C,0):CY=PT(C,1):PRINT "-";:GOTO 280
330 R=RP(INT(RND*V)+1):TX=CX+CD(R,1):TY=CY+CD(R,2)
340 IF (R=1 AND (TX=2 OR TX=QX)) OR (R=4 AND (TY=2 OR
TY=QY)) THEN 330
350 MP(CX+CD(R,1)/2,CY+CD(R,2)/2)=5
360 C=C+1:CX=TX:CY=TY:MP(CX,CY)=R
370 PT(C,0)=CX:PT(C,1)=CY:PRINT "+";
380 IF CX<>QX OR CY<>QY THEN 280
```